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MONOGRAPHIA
APUM ANGLIÆ;

OR,

AN ATTEMPT TO DIVIDE INTO THEIR
NATURAL GENERA AND FAMILIES,

SUCH

SPECIES OF THE LINNEAN GENUS
APIS
AS HAVE BEEN DISCOVERED IN ENGLAND:

WITH

Descriptions and Observations.

To which are prefixed
SOME INTRODUCTORY REMARKS UPON THE CLASS
Hymenoptera,

AND

A Synoptical TABLE of the Nomenclature of the external Parts of these Insects.

WITH PLATES.

VOL. I.

By WILLIAM KIRBY, B. A. F. L. S.
Rector of Barham in Suffolk.

Μικρα εν πετεινοις μελισσα, και αρχη γλυκυσματων ὁ καρπος αυτης.
Ecclūs. XI. 3.

IPSWICH:
Printed for the Author by J. Raw,
AND SOLD BY J. WHITE, FLEET-STREET, LONDON.

1802.

TO

THOMAS MARSHAM, ESQ.

T. L. S. P. R. I.

DEAR SIR,

To whom can I inscribe this little work, such as it is, with more propriety, than to him whose partiality first urged me to undertake it; and whose kind assistance and liberal communications have contributed so largely to bring it to a conclusion.

Accept it, therefore, my dear Sir, as a small token of esteem for many virtues, and of gratitude for many favors, conferred upon

YOUR OBLIGED

AND AFFECTIONATE FRIEND,

THE AUTHOR.

Barham, May 1, 1802.

Magna opera JEHOVÆ, explorata omnibus volentibus ea.
Ps. cxi. 2.

Additional note to the history of Apis Manicata, p. 172-6.

Since this work was printed off, the author met with the following passage in the Rev. GILBERT WHITE's Naturalist's Calendar (p. 109); which confirms what he has observed upon the history of that insect: "There is a sort of wild bee frequenting the garden campion for the sake of its tomentum, which probably it turns to some purpose in the business of nidification. It is very pleasant to see with what address it strips off the pubes, running from the top to the bottom of a branch, and shaving it bare with all the dexterity of a hoop-shaver. When it has got a bundle almost as large as itself, it flies away, holding it secure between its chin and its fore legs."

Directions to the binder for placing the plates.

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Vol. I.

ERRATA ET CORRIGENDA.

Page 22 line 10 from the bottom, and p. 106, line 12, *for* Villars, *read* Villers.
32 line penult. *for* elongata, *read* elongatæ.
85 line antepenult, *for* which Fabricius ſeparated from Apis, *read* into which Fabricius divided Apis
106 line 7 from the bottom, *for* Tuberculi, *read* Tubercula.
130 and 134 note, line 1. *dele* Latr.
146 line 11, *after* depreſſiuſculo, *inſert* punctis excavatis exaſperato; and line 4 from the bottom, *after* minuto, *inſert* trunco punctis excavatis exaſperato.
177 lines 1, 2, for *ano*, *ventre*, read *anus*, *venter*.
189 line 6 from the bottom, *after* minuto, *put* a comma, *and inſert* interioribus lineari-lanceolatis, quam exteriores brevioribus.
200 lines 3, 4, *for* abdomine oblongo, interdum et ſubtriangulari, *read* abdomine ſubtriangulari, interdum oblongo.
217 line 4 from the bottom, *after* 2, *inſert* β.
218 line 5, *for* coaliti, *read* ſubdiſtincti.
229 line 4 from the bottom, *for* fractæ, *read* fracti.
238 line 6, *for* ſpinulæ—ferrulatæ, *read* ſpinula—ferrulata.
247 line 7, *for* interiores, *read* interioris.
248 line penult. *for* interiores, *read* exteriores.
258 line 11 *after* exutus, *inſert* *a a.* moleculæ.

Vol. II.

Page 13 line 6 from the bottom, *for* ſupra nudiuſcula, *read* cinereo-ſubpubeſcens.
14 line 1, *for* cinereo-ſubvilloſa, *read* ſupra nudiuſcula.
15 line 3 from the bottom, *for* Lineella, *read* Linnæella.
line ult. *for* Bankiana, *read* Bankſiana.
17 line 9 from the bottom, and page 35, line 5, *for* Jacobeæ, *read* Jacobææ.
18 line 13, *for* ferrugineo, *read* ferruginea.
23 line 9, *for* ſubpubeſcens, *read* ſubpubeſcente.
24 line 7 from the bottom, *for* rufeſcentibus, *read* flaveſcentibus.
25 line 4, &c. *alter the definition thus: rotundata* A. griſeſcente-villoſa; ore flavo; abdomine ſegmentis margine ſubrufis; thorace *femineo* nigricanti, *maſculo* fulvo.
27 line 2, *for* Francillonana, *read* Francillonella.
28 line 6, *for* Scrimpſhirana, *read* Scrimſhirana.
41 line 17 *for* tuberculi lutei, *read* tubercula lutea.
45 line 16 *for* , *read* 15.
56 line 1, *after* ſulphurei, *inſert* rufo-variegati.
58 line 4 from the bottom, *after* nigræ, *inſert* ſubtus obſcure fulvæ.
135 line 12 from the bottom, *for* hîc, *read* huc.
186 line 12 from the bottom, *for* ferrugineæ. *read* ferruginea.
251 lines 8, 9 from the bottom, *after* manifeſtatori, *and* jaculatori, *inſert* a comma.
309 line 3 from the bottom, *after* antennæ, *inſert* in noſtro ſpecimine.
316 line 17, *for* angulum, *read* angulo.
331 line 14, *after* Latreille, *inſert* a comma.
332 line 3 from the bottom, *for* ad, *read* in.
343 line 16, *after* D, *add* D.

PREFACE.

WHEN the author of the following work first turned his attention to the English *Apes*, he had no expectation of meeting with half the number of species that he has now described; nor had he any other view, than to draw up a short paper to be read at the Linnean Society, and inserted, if deemed sufficiently interesting, in the Transactions of that learned body: but as he proceeded in his undertaking, so much was to be said, it seemed necessary to introduce so many alterations, and such a number of species unexpectedly flowed in upon him from a variety of sources, that, instead of a short paper, he found he had collected materials sufficient for more than a volume: upon this he changed his original intention, and determined to submit his performance himself, not without considerable apprehensions he confesses, to the eye of the public.

Having said this, it may not be improper to give the entomological reader a short sketch of what the author has attempted in this publication. In the first place, in the Introductory Remarks, and Addenda to the first volume, he has given some account of the rise, progress, and present state of the class *Hymenoptera*; and pointed out such improvements, as he thinks it will admit: he then proceeds to examine what advances the genus of which he proposes to treat has made towards perfection. Under each of these heads he has introduced some strictures upon the system of Fabricius, which the occasion seemed to demand: and here he hopes that the friends and admirers of that celebrated entomologist will do him the justice to believe that he has been actuated solely by a desire to promote the cause of truth, and of his favorite science, which, as he conceives, have suffered very materially by the introduction of that system.

The work itself begins with a *Tabula synoptica nomenclaturæ partium*. Upon the construction of this the author has bestowed the greatest attention; and he trusts that it will be found nearly, if not altogether, a complete enumeration of the external parts of the insects of which he treats. Their internal anatomy he has passed over, as not entering within the limits of his plan. This table, if he is not greatly mistaken, with a few slight alterations, may be made to agree with all *Hymenopterous* insects. In it he has introduced and named several parts unnoticed by Linneus, and most other writers in entomology. This is followed by an explanation of the terms used in this table, and the following work. Having thus prepared the way, he next points out those characters, which appear to him to distinguish the genus in question; and assigns his reasons for dividing into two genera those insects which by Linneus were considered as genuine *Apes*, subjoining their *Essential, Artificial, and Natural Characters.* With respect to the last, though he varies from the practice, yet he conforms to the precept of Linneus(*a*); and he thinks that Fabricius has rendered no small service to the science of entomology by the introduction of them. Then succeed, what appear to him, after combining anatomy with habit, economy, and affinities, the *natural* families into which these two genera may properly be divided.

And here, to trace the footsteps, and elucidate the system of nature, and nature's God, has invariably been his aim; to discover the wonderful works, and adore the wisdom of his Creator, his highest pleasure; and to point out HIS meaning, and see things where HE has placed them, his single desire. Unattached to hypothesis, he has made haste to give up errors as soon as he has detected them, and he has taken every step within his power to arrive at the truth. With respect to this part of his undertaking, he has not been satisfied with dis-

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(*a*) Linneus, in his *Methodus demonstrandi lapides, vegetabilia aut animalia,* under the head *Genus,* includes as a necessary adjunct. "*Character Naturalis omnes notas characteristicas possibiles exhibens.*"

secting a single insect in each family; on the contrary, he has omitted no opportunity of examination; and in those subdivisions in which the *proboscis* (b), and its parts seemed most subject to variation, he has inspected that organ in almost every individual that he has described. But still, notwithstanding all his care, he cannot flatter himself that he is altogether exempt from error. These minute parts, be their position varied ever so little under the lens, exhibit an appearance different in some respects. He has endeavoured to represent every thing as it appeared to his eye. Quite a novice in the arts of drawing and etching, his performance must of course be rude, and perhaps sometimes the relative proportion of parts to each other is not represented with entire accuracy; but in this respect he did his best: as to number of parts and general form, he can vouch for the truth of his figures.

These necessary preliminaries discussed, and adjusted, the author proceeds to the description of individuals: and here he thought he could not pursue a better plan, than that excellent one marked out by the Rev. Dr. Goodenough, in his admirable paper on the *British Species of the Genus Carex* (c). He has therefore placed before his descriptions a *Synopsis Specierum*, and subjoined, to such as seemed to require it, some observations in English. In the determination of species, the result of his inquiries, he flatters himself, may prove useful; particularly as his frequent dissections of these insects, and his necessary attention to their most minute parts, have led him to discover those characters, exclusive of the organs of generation, which distinguish the male from the other sexes. By following this clue, he has found that several species, hitherto described as distinct, are only sexual varieties; and, by the assistance of the same circumstance, he has separated many insects of the same sex, which have usually been regarded as such. The opportunity afforded him, by the liberality of the President of the Linnean Society, of consulting the cabinet of Linneus, has empowered him to verify a number of species that have been very much mistaken, or very little known; so that, for the future, he hopes there will be no room for either error or doubt concerning them. To put it as much as possible into the power of entomologists to be acquainted with the insects here described, under each species he has referred to those cabinets in which he knows it to be preserved.

(b) The term, *Rostrum*, has frequently been employed, by Linneus and others, to signify this part; but such an application of it, if entomologists are expected to adhere to the definition of the *Fundamenta Entomologiæ*, is extremely improper. *Os in acumen productum rigidum*, gives to that term a very distinct signification, and altogether at variance with the *proboscis* of a bee.

With respect to *synonyms*, the author spared no pains that his situation permitted him to take. Not possessed of an extensive entomological library of his own, he has omitted no opportunity of consulting those of others; especially the magnificent collection of Sir Joseph Banks, so liberally open to naturalists: but his distance from the metropolis prevented his having any other than occasional recourse to this invaluable treasure-house of Natural History. Knowing how customary it is with authors, not excepting Linneus himself, to adopt *synonyms* without sufficient examination, a practice that has proved a fruitful source of error and almost inextricable confusion, he has been particularly cautious to refer to no author, whose description or figure of any individual insect he has not compared with the insect itself. And, that he might trust as little as possible to memory in this case, he carried his whole collection of specimens both to London and Norwich; so that in this department he hopes he has rectified many mistakes of his predecessors. There is one author, J. L. Christius, who has treated upon the *Hymenoptera* class, of whom he was not able to make so much use as he could have wished, from his ignorance of the German language: to his figures he frequently refers, but as he cannot consult the descriptions, he does this sometimes with less confidence, than if he could compare his insects with both. Mr. Marsham, however, upon whose judgment he places the greatest reliance, compared the specimens with this author's figures, and approved of the references made to them in this work.

(c) Lin. Trans. vol. 2. p. 126, &c.

To elucidate the whole, he has annexed a set of explanatory plates, etched by himself, from sketches of his own; rudely executed indeed, but he hopes sufficiently accurate to illustrate his system.

After all, the author is conscious that he brings far from a perfect work before the tribunal of the public. Much still remains incomplete; and many errors, no doubt, will require future correction. An account of any genus, perfect and elaborate in all its parts, must be the work of him who is versed in the history and economy of every individual that belongs to it, He, and he only can go upon sure grounds, for no other person can in all cases, with certainty, distinguish the species from the variety, and unite each sex to its legitimate partner. But so much knowledge, even with respect to a single genus, where the species are numerous, is not to be expected from one man: nor should the naturalist attempt, like the spider, to weave his web from materials derived solely from within himself; but rather let him copy the industrious bee, and draw genuine treasures from those flowers of science which have been reared by other hands, and combining these with his own discoveries, let him endeavour to concentrate all into one harmonious system, with parts curiously formed, arranged, and adapted to each other, and to the whole; and calculated to preserve the sweets of true wisdom pure and unsophisticated.

The author, in the following performance, may be thought by many, to have multiplied species without necessity; while others will probably object to his having put those together, whose *primâ facie* appearance is entirely different. To the first he begs leave to observe, that insects are not so subject to vary as plants; moreover his discovery of the sexes enabled him to detect those differences that indicate gender, and therefore he could always reduce the question, with respect to any particular insect, into this small compass, viz. whether such variations were likely to occur in the same sex? He does not, however, presume to affirm that he has fallen into no mistakes in this respect; for in two of his subdivisions of genuine *Apes* (*d*), he fears he has not been so successful, in uniting the sexes, as in other families; and in general, where the males and females differ very materially, as they occasionally do both in colour and form, he has probably, in several instances, been led to regard them as distinct species. To the latter he must reply, that he has never united two insects before

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(*d*) The author alludes here to those *Vespiform Apes*, which constitute a considerable part of the Fabrician genus *Nomada*, and also to the *Bombinatrices* of Linneus. Of these, the former seems more subject to vary than any family of the genus; and almost all the distinctions of the latter being taken from the colour of their hirsuties (which varies much, and often in the same individual, in different periods of its existence) of course, in describing them, the entomologist must be liable to many mistakes.

considered as distinct, without very satisfactory proofs of their identity.

To some he may seem unnecessarily minute in the description of species, but the very nature of a *Monograph* seems to imply attention to every circumstance which distinguishes the objects of it (*e*): while, on the other hand, he who undertakes an entire department in Natural History, should select those features principally which distinguish the objects he describes from their congeners. As minute traits of character, and familiar anecdotes, which are beneath the dignity of the historic muse, are accounted a great beauty in biography; and enter into its essence, at the same time that they constitute its most agreeable ornament. Against this objection he cannot shelter himself more securely, and under a greater name, than that of the learned Professor Afzelius, who, in his papers on *three species of Trifolium, and on the genus Pausus,* in the Linnean Transactions (*f*), has exhibited, as nearly as possible, a perfect example of a *Monograph.*

It may perhaps be urged, as another objection against the author, that he has taken an unwarrantable liberty in altering so frequently the *Nomina Specifica* of Linneus and other authors. His

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(*e*) *Monographi vegetabile unicum opere singulari prosecuti sunt, ut eo accuratiùs constent omnia in particulari casu. Naturæ curiosorum institutum laudandum.*

Lin. Philos. Botan. §. 13.

(*f*) Vol. 1. p. 202. and vol. 4. p. 243.

reply to this must be, that he has never done this out of the love of change, but only where it seemed necessary to distinguish one species from another, and in strict compliance with the rules laid down by that great father of natural history, in his *Philosophia Botanica*, where he says, "*Nomen specificum continet differentiæ notas essentiales.*" (g) And again "*Nomen specificum legitimum plantam ab omnibus congeneribus distinguat.*" (h) When, therefore, the Linnean definition of any species does not contain all those characters which constitute its essence, or which distinguish it from its congeners, it is necessary that it be altered, provided this be done *cautè, castè, judiciosè*, according to the same rules. When Linneus published the last edition of his *Systema Naturæ*, the known species of *Apes*, speaking comparatively, were but few, and therefore fewer notes of discrimination would sufficiently point out any individual then, than at this time, when the number of species is increased beyond measure. Much confusion has unavoidably been introduced into the genus by this brevity, for the same definition will now be found to agree with several distinct species (i).

(g) §. 256.

(h) §. 257. He says under another section (294), *Qui novam detegit speciem, addat et non modò ejusdem differentiam, sed et in congeneri vel congeneribus differentias augeat, ut distinguantur in posterum species sufficienti differentiâ.*

(i) E.G. The definitions of *Apis cunicularia, centuncularis, conica, succincta,* &c.

The author has experienced no small difficulty in assigning *Trivial Names* to such species as appeared to be non-descript: his aim has been so to construct them, that they may point out some prominent feature of the insect which they denote, or allude to some remarkable circumstance in its economy: but the species of this genus are so seldom distinguished by singularity of form, or variety of colouring, that he has often been at a loss to fix upon an appropriate name; and he fears that many will be thought not so happily illustrative of their subject as he could wish. Where the same insect has been described by several authors under different *Trivial Names*, he has generally made it a rule to retain that imposed by him who first noticed it. Many of his non-descripts he has named after the entomologists of this country, whether writers or collectors only, distinguishing the former by the termination *ella*, and the latter by *ana*, in conformity to the practice of Linneus in the *Tineæ* and *Tortrices*. If he has omitted any gentleman who is entitled to a place, he hopes it will be imputed to ignorance rather than design.

The author would be unpardonable, were he to conclude this preface, without acknowledging his obligations to those gentlemen, whose libraries and cabinets he has been allowed the liberty of consulting.

To Sir Joseph Banks, Bart. this, and every work, in whatever department of Natural History, undertaken

taken in England, will of course be under the greatest obligations. His unrivalled library, stored with almost every publication that a naturalist can wish to consult, and his cabinet rich in exotic and indigenous treasures, and open to the most unreserved inspection, afford writers of this class, who reside in this country, a most decided advantage over those of every other.

To Dr. Smith, the President of the Linnean Society, he is indebted not only for the invaluable opportunity of consulting at his ease the Linnean cabinet and library, by which he has been enabled to determine so many dubious species, and to extricate the genus of which he treats from much of the confusion in which it was involved, but also for his personal kindness and constant encouragement.

He scarcely knows what terms to employ that will sufficiently express his obligations to Mr. Marsham; whose friendship, from the first to the last, has exerted itself with unwearied assiduity, to give, or procure him, every information in his power; securing him an access to all the cabinets of the metropolis; introducing him, a stranger, and unknown, to the most eminent entomologists; impoverishing his own collection to enrich that of the author: in a word, taking every occsion to serve him, and his friends, to the utmost of his power.

To Drs. Goodenough and Latham, Major Gen. Davies, and Messrs. Drury, Sowerby, Donovan, Mc Leay, Jones, Haworth, Hill, Coyte, Francillon, he begs to return his grateful acknowledgments, for the permission, with which they indulged him, of consulting their respective collections. To the Rev. Peter Lathbury, he is indebted for much assistance every way. To the industry, and accuracy of observation of his ingenious relation Mr. James Trimmer, he owes the discovery of several nondescripts, also much original matter, and many interesting particulars relative to the history and economy of several of the insects described in the following pages.

N.B. The reader is requested to observe that all the descriptions in the following work were taken from insects viewed under a lens.

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Zschach, J. T. Museum N. G. Leskeanum pars entomologica. 8vo. Lipsiæ, 1788.

INTRODUCTORY REMARKS.

BEFORE I begin my description of the British species of the genus *Apis*, I propose to offer a few preliminary observations upon the *Hymenoptera* class; consisting of a short review of its history previous to the time of Linneus, an account of what has been done in it by him and his successors, and ending with a particular inquiry into the present state of the genus, which I have undertaken to elucidate. These, I hope, will furnish satisfactory reasons for those alterations which I have found myself under the necessity of making, and for that method of arrangement which I have adopted.

The Great Parent of the universe, when he furnished this terrestrial globe with its inhabitants, caused the earth and waters, as the sacred historian informs us(*a*), to produce every thing "according

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(*a*) Genesis i. 11—25.

to its kind"(*b*): an expression, which if taken in its largest sense, as I think it will well bear in the places referred to in the margin, may be understood to signify the distribution of all created species, not only into *Families* and *Genera*, but also into *Orders*, *Classes*, and *Kingdoms*; and so into a harmonious system, every member of which, although it has a separate place and office assigned it, is connected, by certain common marks and characters, with those which precede or follow it. And the book of nature in this, as in all other respects, speaks the same language with the book of revelation; we see every where the traces of a natural system, and both reason and observation unite in declaring that such a system, with its regular divisions and subdivisions, does exist. Now if the glory of the Creator be, as it assuredly ought, the great end of the labours of the naturalist; then the most effectual way to promote this great end, is to aim at the elucidation of the genuine *systema et oeconomia naturæ*, that we may see natural objects, as much as possible, in the places which the Divine Wisdom has assigned to them; and learn, every day, more and more of the natural juxtaposition of *Species*, *Families*, *Genera*, *Orders*, *Classes*; and of their individual and collective economy, &c. &c. It is true, in our present degenerate state, fallen from original knowledge

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(*b*) Heb. למינהו. The root מנה and its derivative מין imply distribution and orderly arrangement.

as well as virtue, having lost that genuine *Clavis Naturæ*, which it is probable our primogenitor Adam possessed (*c*); by the use of which, in the creature he could discern the intention of his Creator: in this world and its productions, seen in their various affinities and economies, read his deity and attributes, his wisdom and will, and things spiritual: so that to him, the page of creation was a revelation by natural symbols and types, as the Jewish religion was by instituted, and the Christian by words, the arbitrary signs of ideas; and, in consequence of this knowledge, was enabled to impose upon the creatures, names adapted to their several natures. I say, in our present degenerate state, we cannot attain to this wisdom of the protoplast, for now "we know only in part (*d*)." Yet, by combining our own observations upon nature with those of others, who before us have laboured in the same field, we shall gradually approach more and more towards it, till, perhaps, if it be the Divine Will, we attain to the full day of the glory of our Creator, as manifested in his creatures. If that glorious day of true and genuine science should ever come, we shall then behold each natural object in its proper place; we shall learn its history, economy, and uses, its moral and spiritual signification, and find

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(*c*) *Quod ad Historiam Naturalem attinet, duæ ejus partes, Zoologia et Botanica, testantibus hoc plerisque theologis et philosophis, primi generis nostri parentis fuere studia.* Fundament. Entomolog. 4to. p. 4.

(*d*) 1 Cor. xiii. 9.

God's works and God's word, "though each in different sort and manner," uniting to declare the same truths, and, with one voice, impelling us forward to the attainment of the true end of our being, the knowledge and enjoyment of HIM, who is essential POWER, WISDOM, and LOVE, through that BLESSED PERSON, who having first created us, afterwards assumed our nature and died for us, and in that world of realities of which this is only the type and the shadow. May that day ever more and more approach; to hasten its dawn is the peculiar office and duty of the naturalist, who is the *Hierophant* in the great temple of nature; and this can only be effected by opening our eyes to the light which nature herself affords to those who seek for truth: by recording, not our own private hypotheses, but our discoveries; by improving, instead of destroying, what others have done; by retaining what is already discovered of the natural system, and endeavouring to add to it; remembering always that we are not the heralds of our own fame, but of the glory of our GOD. So that we may ever be willing to exclaim in the words of the divine psalmist: "The works of JEHOVAH are great, sought out of all them that have pleasure therein. His work only is excellent, and his praise above the earth and heaven."

Of all the departments of the animal kingdom, the entomological affords the fairest opportunity of discovering the natural classes; and accordingly the penetrating genius of Linneus, enabled him, in the later editions of his *Systema Naturæ*, to arrange the insects he described as nearly as possible according to the natural system. A few genera, perhaps, in the *Hemiptera* and *Aptera* classes, may be placed in a wrong one; but these, compared with others which are stationed in the situation, as to class at least, in which nature has placed them, are but few. Where then is the force of the objection of Fabricius to Linneus, that "*nimis naturam sequens, sæpius amisit systema*(e)?" The end of all artificial systems is solely to facilitate the study of nature, and to prepare the way for the discovery of that which is natural; which, as Linneus justly terms it, is the *primum et ultimum* (*f*). Therefore, when we have a system that for the most part harmonizes with nature, is such an objection to be raised against the illustrious author of it? And are we to be told, with respect to natural classes, "that the proper time to elaborate them is not yet arrived, since we are as yet but tyros in the science(*g*)?" To hear this author speak of the Linnean system, one would suppose that entomology, instead of being under any obligation to it, had received great injury from it, and that

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(*e*) Philos. Ent. c. vii. § 2. (*f*) Philos. Bot. § 77.

(*g*) *Naturales existere insectorum classes vix dubitandum. Suadent ratio, detecta, observata. At nondum tempus est eas elaborare, quum tyrones adhuc scientiæ simus.* Philos. Ent. c. vi. § 7.

he himself was its great upholder and restorer. Hear his own words: "*Vidi vacillantem entomologiam, classes ludicras, genera falsa, species haud determinatas, et nomina sæpius absurda* (*h*)."

If we compare the characters of the Linnean classes, with those of Fabricius, we shall find the former, simple, obvious, applicable, with few exceptions, to all the genera that compose each, and distinguished by a significant name; while those of the latter are seldom to be detected without dissecting the insect; and, if I may be allowed to form a judgment from the *Hymenoptera* class, not universally applicable; with a name assigned to each barbarous, ill-constructed, and far from significant. To give up the classical, harmonious, and connected names of the Linnean classes, for such barbarisms, as *Eleuterata, Ulonata, Synistata, Piezata, Odonata, Mitosata, Polygonata, Kleistagnatha, Exochnata*, &c. is what, I should apprehend, no naturalist, who is at the same time a scholar, and has any ear, will ever consent to.

The end of system, as I just now observed, is to facilitate study, but Fabricius, in his eagerness to innovate, has fixed upon characters taken from organs, which, in a large proportion of insects, are

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(*h*) Philos. Ent. Præfat. p. 1, 2. When one sees Fabricius and his followers, in their *Synonyms*, placing his name before that of Linneus, under insects first described by the latter, one cannot help feeling some emotions of anger at the indignity thus put upon that illustrious naturalist.

absolutely invisible, or next to it; and for the sake of systematic confusion has discarded nature and all orderly arrangement, and instead of facilitating, has perplexed the study of entomology with difficulties that are innumerable and inextricable (*i*). The rage of the present unhappy æra is not for the amendment or improvement of what has been done before,

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(*i*) If the reader will take the trouble to turn over the Supplement to the *Entomologia Systematica,* he will be convinced that the language here employed is far from being too strong. He will there see, to use an emphatic phrase, *omnia misceri.* Instead of a regular and harmonious system, like that of Linneus, a Babel of confusion and division. Instead of a gradual descent towards those insects which nature has placed next to the *Vermes,* he will find many of these stationed before the *Lepidoptera!!* For instance, after the *Coleoptera* and a few genera of *Hemiptera,* come some of the *Neuroptera* and *Aptera* mixed together; these are followed by the *Hymenoptera,* which precede more *Neuroptera.* Then appear five classes of *Aptera,* the two last of which are made entirely out of the Linnean genus *Cancer,* divided into *twenty-seven* genera!!! These are succeeded by the *Lepidoptera,* followed by the rest of the *Hemiptera*; and the discordant catalogue, *Partium inter se non bene cohærentium,* concludes with *Diptera* and *Aptera.* If he turns his attention from the classification to the genera, he will be surprized to see families of the same natural genus forced violently asunder, and separated widely from each other. Thus *Trichius, Cetonia,* and *Melolontha,* disunited from *Scarabæus,* to which God and Nature had joined them, are placed next before *Buprestis.* Again, he will there see Fabricius deserting his own system, and taking the *Artificial Characters* of no fewer than *twenty-one* genera in his *Kleistagnatha* and *Exochnata* classes from the *Antennæ* solely, without making any mention of the *instrumenta cibaria,* upon which it is founded.

before, but in these days a man thinks himself no philosopher, unless he can altogether obliterate, and for ever do away the collected wisdom of the ages that are past, in order, in its stead, to erect a novel system of his own: this is the case in religion, morals, politics, and philosophy; and in all these this Καινομανια has produced the most mischievous effects. But it ought to be recollected, that if the flimsy, and destructive web of a spider be the work of a single insect and spun in an hour, yet that to form and replenish the admirable structure sheltered by the hive, it requires, and for the best portion of the year, the united labours of myriads of industrious bees. Just emblems of the patient efforts of genuine science.

Had Fabricius, instead of overturning, employed himself in giving those improvements to the system of Linneus, of which it is capable, and which indeed it demands; the entomological world would have been his debtor; and under so skilful a hand, the science, instead of being thrown back, would have made considerable advances. Whereas, in the system that he has produced, what have we gained but a confused mass of unnatural classes, founded upon evanescent characters, designated by barbarous names, and puzzling the student with old terms turned aside from their original signification, and improperly applied to new objects (*k*)?

(*k*) E. G. *Maxilla, Labium, Clypeus,* &c.

I should not have taken so much liberty in my strictures upon the system of this celebrated author, had not many eminent entomologists upon the continent adopted it without reserve, and endeavoured to force it upon the public. A conduct which I conceive to be most prejudicial to the interests of science, and unjust to the merits of the greatest uninspired naturalist that ever lived. In justice to my own countrymen I must not omit to observe, that this system has gained very little ground in England.

At the same time, although I have spoken my sentiments so freely of the system of Fabricius, it is with pleasure I acknowledge that his *Philosophia Entomologica* is a work of standard merit, which deserves to be thoroughly studied by every entomologist, and if he had written nothing else, this alone would have entitled him to be ranked amongst the first philosophers of the age in which he lives (*l*). The construction of *Natural Characters*, although chiefly drawn from those inconspicuous parts on which he builds his system, is a great point gained in the science; and in general if, in some respects, he

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(*l*) I must except, however, from this praise, many of his definitions: E.G. *Abdomen Conicum, Cylindricum*, &c. where the usual sense of these terms is clogged with unnecessary additions. Philos. Ent. c. ii. § 12. &c. It were to be wished that in all cases the definitions of the *Fundamenta Entomologiæ* of Linneus had been primarily adhered to.

he has done great injury to it, in others he has certainly contributed much to its advancement.

But let us leave these general observations, and turn our attention to the class, of which we propose to give some account. It is curious, and not altogether unprofitable, to trace science from the cradle to its manhood, and pursue it through all its intermediate advances. Before I begin, therefore, with what Linneus, his disciples, and successors have effected, I shall give a short view of what had been done, in the *Hymenoptera* class, by the predecessors of that illustrious naturalist. If I mistake not, our own country had the honour of paving the way for the system of Linneus. A brilliant constellation of geniuses arose towards the close of the seventeenth century, who diffused new light over every department of natural history, and were the harbingers of that bright day, which the labours of the great Swedish naturalist have caused to dawn upon the three kingdoms of nature. In this constellation, the stars of the first magnitude and brightest lustre were John Ray, that glory of England, Dr. Martin Lister, and Francis Willughby, Esq. These great Men, by their separate and joint labours, prepared the materials for the present improved state of Natural History.

Before their time, some kind of form had been given to entomology by their predecessors, and the foundations of the class in question, rude indeed and imperfect, had been laid. In Charleton's *Onomasticon Zoicon*, a work of merit for the time, a distinct existence is given to those insects destitute of *Elytra*, which construct combs, denominated "*Insectorum ανελυτρων favificantium classis*" (*m*). This definition, imperfect as it is, for it excludes the major part of genuine *Hymenopterous* insects, possesses this merit, that it admits none that do not belong to that class. Ray, whose indefatigable exertions brought copious and bright accessions of genuine light to every branch of natural history, sensible of the deficiency of the old method, has elaborated this class with considerable care, extending indeed its limits too far, so as to include most of the present *Neuropterous* Genera; but at the same time taking in all the genuine *Hymenoptera*; and thus laying the foundation, with few alterations, for an appropriate and discriminative character of it. The following are the alterations that he has introduced. He puts into one subdivision, under the title of *Tetraptera*, all such insects, with four membranaceous wings, as are quiescent in their intermediate state, thus arranged:

(*m*) Onom. Zoic. p. 36. I quote this author because I have him at hand, and he professes to combine the information to be found scattered in the works of preceding naturalists. He borrows his method from *Aldrovandus*. Vid. Præf. p. 10.

Τετράπτερα seu Quadripennia.	*Gregaria & favifica.*	Mellifica.	Corpore longiore angustiore et glabriore. *Apis Mansueta.*	
			Corpore breviore latiore et hirsuto. *Bombylius.*	
		Non Mellifica.	Majora. *Crabrones.*	
			Minora. *Vespæ.*	
	Solitaria. Non gregaria. Neque favifica.	Apiformia.		
		Vespiformia.	Corpore breviore et habitiore abdomine thoraci prope admoto. *Muscæ Vespiformes.*	
			Corpore angustiore et productiore abdomine tenui et longâ fistulâ thoraci adnexo. *Vespæ Ichneumones.*	*Majores.* *Minores.*
		Papilioniformia.	e Phryganeis *ſ.* vermiculis domiportis oriunda.	
		Seticaudæ seu Tripilia.		

From this view of what our great naturalist has done in this class, it appears that nothing was wanted to make it a natural class, but to fix upon a character in addition to "*Alæ quatuor membranaceæ,*" which would exclude those *Neuropterous* genera that he included in it (*n*).

Dr. Martin Lister, in an appendix to Ray's *Historia Insectorum*, has included all insects, with four naked wings, in one division subdivided into

α *Papiliones, Libellæ,* &c.

β *Apes, Vespæ, Crabrones,* &c.

(*n*) We see in the foregoing table of the Raian system, as to this class, that he divides it into two orders, the first containing what may be denominated two subdivisions and four genera, and the other four subdivisions and as many genera.

We see what a near approach these illustrious Englishmen made to nature with respect to this class, and that in this country it assumed some distinct form, and those foundations were laid, upon which a perfect system might be erected. But though the class was nearly extricated, the genera still remained involved in confusion, distinguished by no certain characters, and often merely by names (*o*).

Such was the state of this class, when Linneus, amongst his other immortal labours, undertook the reformation of entomology. The first outline of his *Systema Naturæ* was published in 1735; whether at that time he was acquainted with what had been done in England in that science, I do not know, but I should think, if he had bestowed much attention on the *Methodus Insectorum* of Ray, he would have gone further than he did in that outline: for in it he puts into one class, the *Lepidoptera*, *Neuroptera*, *Hymenoptera*, and *Diptera*, to which he gives the name of *Angioptera*, a term of similar import with *Neuroptera* (*p*). This class he defines "*Alæ omnibus datæ elytris destitutæ.*" In it he gives the characters of only two genuine *Hymenopterous* genera, *Apis* and *Ichneumon*, which he draws from variations in the *Aculeus* (*q*).

(*o*) I have passed over the system of Swammerdam, as built intirely on the metamorphoses of insects.

(*p*) Them. Αγγειον, *vas*, and πτερον, *ala*.

(*q*) *Apis* cauda aculeo simplici. Alæ quatuor. *Ichneumon* cauda aculeo partito. Alæ quatuor.

The first of these genera he divides into four families, viz. *Crabro, Vespa, Bombylius*, and *Apis*; and the latter into two, viz. *Ichneumon* and *Musca Tripilis*. This outline contains no enumeration of species. In the second edition, published five years afterwards, (1740) the genuine *Hymenoptera* are at length placed by themselves under the name of *Gymnoptera* (*r*), but the number of genera remains the same, only the order of families in *Apis* is changed (*s*). This may be called the æra of this natural class, when it received a separate existence. In the fourth edition, which appeared in 1744, it had its present name assigned to it (*Hymenoptera*) and is defined, *Alæ Membranaceæ*. Linneus now arranged the insects in it under four genera, viz. *Tentredo* (*t*), *Ichneumon* (*u*), *Apis* (*x*), *Formica* (*y*). In 1746 the first edition of that admirable work, the *Fauna Suecica*, was published, giving the same number of genera in this class, but reducing the families in *Apis* to three (z). Species are now enumerated for the first time with the addition of *Nomina specifica*, and descriptions. In this *Tenthredo* includes Cynips, Tenthredo, Sirex and some of the Ichneumones minuti. *Ichneumon* unites

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(*r*) Them. γυμνος, *nudus*, and πτερον *ala*.

(*s*) *Apis, Crabro, Bombylius, Vespa.*

(*t*) *Aculeus ani dentatus.*

(*u*) *Aculeus ani triplex.*

(*x*) *Aculeus ani simplex.*

(*y*) *Squama erecta thoracem ab abdomine distinguens, alæ neutris nullæ.*

(z) Viz. * *Vespæ.* * * *Apes propriè dictæ.* * * * *Bombylii hirsuti.*

some Spheces to the genuine Ichneumons. *Apis* comprehends Vespa, Sphex, Chrysis, and Apis. In all 101 species are described without *Trivial Names.* In the sixth edition of the *Systema Naturæ,* which came out in 1748, the species are for the first time enumerated and defined; a new genus, *Cynips,* is introduced, and a new character formed for *Tenthredo* (*a*). This edition is also distinguished by the convenient adoption of *Trivial Names.* No further improvements were made by Linneus in this class, till the publication of the tenth edition in 1758, in which the present characters of both class and genera are finally given.

From this summary view of the progress of Linneus in perfecting the *Hymenoptera* class, it appears that he was long in giving it all the improvement of which he thought it capable. His original idea seems to have been to construct his genera from variations in the *Aculeus*; to this he adhered through nine editions of his *Systema,* till at length, finding that the same kind of *Aculeus* was common to more than one natural genus, he had recourse to other parts for his characters; he still keeps it, however, at the head of his *Essential Characters,* and has added no other in his four first genera.

The orders into which Linneus thought of dividing this class, as appears from the *Fundamenta*

(*a*) *Cynips* Aculeus ani conico-carinatus. Larva intra gallam.
Tenthredo Aculeus ani feminis serratus. Larva polypoda.

Entomologiæ (*b*), though not distinguished by his usual mark the asterisk, are * *aculeo miti*, * * *aculeo punctorio*. The former division including *Cynips*, *Tenthredo*, *Sirex*, *Ichneumon*, and the latter the remaining genera.

The parts he uses in his definitions of the genera of this class, are 1. *The Proboscis* (*c*). 2. *The absence of it* (*d*). 3. *The absence of the Tongue* (*e*). 4. *The Palpi* (*f*). 5. *The Maxillæ* (*g*). 6. *The Antennæ* both with respect to form and number of articulations (*h*). 7. *The Thorax* (*i*). 8. *The Scutellum* (*k*). 9. *The Wings* (*l*). 10. *The Abdomen* (*m*). 11. *The Aculeus* (*n*). 12. *Pubescence* (*o*). 13. *The absence of it* (*p*). 14. *Colour* (*q*). To distinguish his families he has recourse to the *Antennæ* (*r*), *Abdomen* (*s*), *Hirsuties* (*t*), and *Colour* (*u*) The number of species described in the twelfth edition of the *Systema Naturæ* in this class is 314.

Having given this short account of the labours of Linneus in this class, I shall bestow a few pages upon what his successors have attempted with the

view

(*b*) *Hymenoptera* (*distinguuntur*) *secundum aculeum punctorium vel mitem.* Fundament. Entomol. 4to. p. 29.

(*c*) *Apis.* (*d*) *Cynips, Tenthredo, Chrysis, Vespa.*

(*e*) *Ichneumon, Sphex.* (*f*) *Sirex.* (*g*) All except *Formica* and *Mutilla.* (*h*) *Sirex, Ichneumon, Sphex, Chrysis.*

(*i*) *Mutilla.* (*k*) *Tenthredo.* (*l*) *Tenthredo, Sirex, Sphex, Vespa, Apis, Formica.* (*m*) *Sirex, Ichneumon, Chrysis.*

(*n*) All the genera. (*o*) *Mutilla.* (*p*) *Vespa.* (*q*) *Chrysis.*

(*r*) *Tenthredo, Ichneumon.* (*s*) *Ichneumon.* (*t*) *Apis.*

(*u*) *Ichneumon.*

view of improving upon him. The first that I shall mention is Professor Scopoli, a name dear to every lover of Natural History, and to whom entomology is under very considerable obligations. In his *Entomologia Carniolica,* he has distinguished four of the Linnean classes by new names. I must confess I prefer the old ones, on account of that harmony of nomenclature which distinguishes them, from the same word entering into the composition of them all. The present he names *Aculeata.* Considered out of its connexion, this is certainly more expressive of the peculiar character of the class, than the word *Hymenoptera.* But, in a system, nothing ought to be taken by itself, and the general harmony and union of parts should be considered as well as individual propriety. I see no good reason, likewise, for his alteration of the Linnean definition of the class. "*Alæ quatuor membranaceæ plerisque. Aculeus caudæ, sed nullus in maribus*" is more appropriate, especially with respect to those genera which have two aculeate sexes, than "*Alæ quatuor, abdomen uni sexui aculeo armatum.*" In the genera, this author, instead of improving upon what Linneus had done, goes backward by reuniting *Sirex* with *Ichneumon,* and *Chrysis* with *Sphex,* genera surely sufficiently distinct. His alterations of the Linnean *Essential Characters* do not seem always to be for the better(*x*).

(*x*) E. G. He has altered the Linnean essential character of *Mutilla.* "*Aculeus punctorius, alæ neutris nullæ*" into "*Alæ nullæ*", when one sex in this genus has wings.

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For the construction of these he has recourse to 1. *The proboscis* (y). 2. *The absence of it* (z). 3. *The wings* (a). 4. *The absence of them* (b). 5. *The aculeus* (c). The distinctions of his families are taken from the *antennæ* (d), *wings* (e), *abdomen* (*f*), *aculeus* (g), and *colour* (h). The genus *Apis*, as I shall afterwards have occasion to observe, is under considerable obligations to this author.

Next to Scopoli comes Geoffroy, a writer of considerable merit, but too much given to innovation; he had studied Linneus, and professes to follow nature (i), yet he falls into great errors by departing from both. After Ray, he reunites the *Neuroptera* and *Hymenoptera* classes under the denomination of "*Insecta tetraptera alis nudis*;" and thus loses all the ground that had been gained by Linneus. This class he divides into three sections, the first of which contains such of these insects as have *tarsi* of three joints; the second, those whose *tarsi* have four joints; and the third, those whose *tarsi* consist of five joints. This last section puts together, contrary to nature, their economy, and affinities, *Ephemera*, *Phryganea*, *Hemerobius*, *Myrmeleo*, *Panorpa*, and the *Hymenoptera*,

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(y) *Apis*. (z a) *Sphex, Vespa*. (b) *Formica, Mutilla*.

(c) *Cynips, Tenthredo, Ichneumon, Sphex*. (d) *Tenthredo, Apis*. N. B. In the latter, the circumstance which he has taken for the characteristic of a family, is only a sexual distinction.

(e) *Ichneumon*. (*f*) *Ichneumon, Sphex*. (g h) *Ichneumon*.

(i) Hist. Ins. tom. 1. Disc. Prel. p. xvii.

noptera. His genera in the latter are *Crabro* (*k*), *Urocerus* (*l*), *Tenthredo*, *Cynips* (*m*), *Diplolepsis* (*n*), *Eulophus* (*o*), *Ichneumon* (*p*), *Vespa* (*q*), *Apis*, and *Formica*. In all these his generic characters are drawn from the *mouth* (*os*), *stemmata*, *antennæ*, *wings*, *abdomen*, and *aculeus*, with the addition of *lingua*, *glabrities*, and *hirsuties* in *Vespa* and *Apis*. His families are taken from the number of articulations of the *antennæ* (*r*), and *pubescence* and *hirsuties* (*s*). The monotony of his generic characters is rather tedious, and his constant adherence to differences in the antennæ for them leads him into many errors. He has often fallen into the very faults that he objects to Linneus (*t*); for the characters of his genera are not sufficiently descriminative, he unites those insects which nature has separated, and separates those which she has united. For instance, the only distinction between *Apis* and *Vespa*, which he notices, is pubescence (*u*); thus placing a considerable family of genuine *Apes* in the latter genus, which likewise includes *Chrysis*. Again, he separates *Crabro* from *Tenthredo*, and *Eulophus* from *Ichneumon*, merely on account of differences in the *antennæ*,

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(*k*) *Tenthredo*, Lin. (*l*) *Sirex*, Lin. (*m*) *Cynips* and *Ichneumon*, Lin. (*n*) *Cynips*, Lin. (*o*) *Ichneumon*, Lin.

(*p*) *Ichneumon*, *Sphex*, Lin. (*q*) *Vespa*, *Chrysis*, *Apis*, Lin.

(*r*) *Tenthredo*, *Cynips*. (*s*) *Apis*. (*t*) Tom. 1. Prel. Disc. p. xiv. (*u*) *Vespa* corpus glabrum. *Apis* corpus villosum. All the other characters are verbatim the same.

which in both these genera, I speak only of the *minuti* of the latter, are subject to continual variations. In *Eulophus* the *antennæ ramosæ* are only a sexual distinction (*x*). The separation of the *minuti* from the genus *Ichneumon* by this author, appears to me to be a point gained in this class, but he has intermixed these with *Cynipes* in his two genera *Cynips* and *Diplolepsis*. The latter, according to his characters, should include the genuine *Cynipes*, and the former the *Ichneumones minuti*.

The Baron De Geer, who, like his illustrious predecessor Reaumur, penetrated into the deepest recesses of nature in the pursuit of truth, and brought forth to light and notice innumerable anecdotes and facts, before unknown, relative to the history and economy of the minute, but wonderful, animals which belong to the entomological department; by this very circumstance was enabled, more than any of his predecessors, to improve the Linnean generic characters in this and other classes, and to render them applicable with more certainty to the species which they were intended to distinguish. He has nearly inverted, with what propriety I shall not now enquire, the Linnean order of *Hymenopterous* genera (*y*), and

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(*x*) De Geer, tom. 2. p. 2. Mem. 15. p. 901. Tab. 31. fig. 14—17. Kirby in Lin. Trans. vol. 5. p. 109. note t.

(*y*) Thus: *Apis, Nomada, Vespa, Sphex, Chrysis, Sirex, Ichneumon, Cynips, Tenthredo, Formica.*

separated, with great judgment, the *Proabeille* of Reaumur from *Apis*. His generic characters are taken from the *mouth* (*os*), *antennæ*, *wings*, *abdomen*, and *aculeus*, which are introduced into every genus. The *proboscis*, which not only distinguishes *Apis* and *Nomada*, but is also very properly noticed in *Vespa*. The *eyes*, *Apis*, *Nomada*, *Vespa*, and *Sphex*. This Linneus, in the twelfth edition of the *Systema Naturæ*, has adopted with respect to *Vespa*. The *anus*, *Chrysis* and *Sirex*. His families, in which he has improved much upon Linneus, especially in *Ichneumon* and *Formica*, are taken from the *antennæ* (z), *the absence of the wings* (*a*), and *the abdomen* (*b*). Both this author and Geoffroy, without sufficient reason, have taken perpetual liberty to alter the Linnean names of the genera, a practice which has occasioned a great deal of confusion and answered no good end.

Schrank, in his *Enumeratio Insectorum Austriæ*, has added the following circumstance to the Linnean definition of the class, "*Os maxillis transversis*." This character, which runs through all the species, seems well introduced, and renders the endless repetition of "*Os maxillis*," in the *Artificial Characters* of the genera, perfectly needless. He has also introduced some slight alterations into the generic characters of *Sirex*, *Ichneumon*, *Sphex*, *Chrysis*, and *Formica*; but in the main he adheres to those of Linneus.

(z) *Sphex, Ichneumon, Tenthredo.* (*a*) *Ichneumon.*

(*b*) *Ichneumon, Formica.*

From

BIBLIOTECA NAZ. VITTORIO EMANUELE ROMA

From this recapitulation of what has been done by Linneus and others, it will appear that no very essential improvements have been made in this class, from the time of the publication of the tenth edition of the *Systema Naturæ* in 1758, to the time when the system of Fabricius first made its appearance in 1775. Only two good genera had been separated from those of Linneus; the *Nomada* from *Apis*, after Reaumur, by De Geer, and the minute *Ichneumons* by Geoffroy, but confounded with *Cynips*. A slow progress, and by no means equal to that of botany, considering the vast number of non-descript species discovered during this period.

I shall now call the reader's attention to what has been attempted by Fabricius in this class. Originally he united together *Ephemera*, *Phryganea*, *Hemerobius*, *Termes*, *Myrmeleon*, *Panorpa*, *Raphidia*, all the *Hymenoptera*, *Monoculus*, *Oniscus*, *Lepisma*, and *Podura*. "*Turba sanè stupenda*," as Villars justly exclaims (c), "*insolita, sed instrumentis cibariis approximata!*" Probably the absurdity of uniting in one class so heterogeneous a mixture of genera, as opposite to and unconnected with each other as light and darkness, induced this author in his *Entomologia systematica emendata et aucta*, published in 1793, at length to give to the *Hymenoptera* class a separate existence, under the name of *Piezata*; a word, derived, I presume, from πιεζω, *premo*. His definition of this class is this: "*Palpi quatuor; maxilla cornea, compressa, sæpe elongata.*

(c) Ent. Eur. tom. 1. p. 580.

Before I consider how far this character may be regarded as applicable, it will be proper to inquire into the meaning of the terms which Fabricius has employed to signify those parts from which he has borrowed the characters of the class and its genera; to point out by what names they are distinguished in the *Tabula synoptica nomenclaturæ partium* of the present work, and to refer to the figures designed to represent them. This will enable the reader to judge with precision how far the author is warranted in the objections which he urges against the Fabrician system.

Fabricius, in his preface to his *Genera Insectorum*, has assigned it as a reason for his omission of figures, that they would generate confusion in the determination of species, on account of the variations to which the *Instrumenta cibaria* are subject in individuals of the same genus (*c*). But, how good soever this argument might hold with respect to generic characters; yet, when new terms are introduced into a science, or old ones used in a new sense, to prevent mistakes and confusion, it is extremely convenient, if not absolutely necessary, that they should be illustrated by figures. And when this author first laid his system before the public, the *Instrumenta cibaria*, upon which it is founded, ought not only to have been defined

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(*c*) p. 8, 9.

clearly, but an accurate delineation of each part, and its natural situation, should have been made and referred to.

The parts from which Fabricius has taken his characters of this class and its genera, that seem to require explanation, are *lingua*, *labium*, *maxilla*, *palpi anteriores*, *palpi posteriores*, *mandibula*, *clypeus*.

LINGUA. Fabricius defines this part "*Lingua spiralis inter palpos reflexos latens convoluta*(*d*)." And at the end of his chapter on the *Instrumenta cibaria*(*e*), he says "*Maxillæ, labiumque elongata, membranacea, inter mandibulas inflexa, linguam constituunt.*" But this latter definition, from a subsequent observation, seems intended solely to denote what he means by *lingua* in *Apis*, and the genera he has separated from it, &c. and the former to apply chiefly to the tongue of the *Lepidoptera*. From hence it appears that the term *lingua*, in this class, is equivalent to the Linnean term *proboscis*; including the whole machinery of that organ (*f*). It seems to me that this term ought to be applied exclusively to the instrument which acts the part of a tongue.

LABIUM. The definition is "*Labia os infernè claudentia, ne hausta eruant* (*g*). This term

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(*d*) Philos. Ent. c. ii. § 3. In another place he defines it "*Lingua spiralis convoluta bifida, inter palpos stuposos inserta,*" manifestly referring to the *Lepidoptera.* Ibid. c. iii. § 1.

(*e*) Ibid. § 18. (*f*) Tab. 11. * *. d. 2. α. fig. 1.

(*g*) Philos. Ent. c. ii. § 3.

is intended to denote that part of the *proboscis* which is seated between the *maxillæ* or *valvulæ*, and from which the *posterior palpi* are produced; as applied by Fabricius, in his genera in this class, it includes both the real tongue, and that part which I have denominated *tubus* (*h*), or its corneous base: if it had been confined to the latter, and called *labium inferius*, it would have been proper enough (*i*); but, as it now stands, that part which collects, absorbs, and passes the honey down into the stomach is called *labium*, which is certainly very improper, not to say absurd. Under this head are to be considered those parts, defending the tongue where it issues from the tube, which he calls *setæ*, or *linguæ laciniæ ſ. laminæ interiores* (*k*); which terms include what, in my first genus *Melitta*, are named *auriculæ* (*l*), and in *Apis*, *laciniæ interiores* (*m*). The term *seta* is often not properly applicable to them. His *labii laciniæ laterales* (*n*) *ſ. exteriores* (*o*) answer to my *laciniæ exteriores* (*p*).

MAXILLA, is thus defined. "*Maxillæ duæ transversales, sæpius membranaceæ, latera oris*

(*h*) Tab. 11. ubi supra *d*.

(*i*) As this part embraces and seems connate with the lower part of the tongue, which it defends externally, I preferred another term to *labium*.

(*k*) See his *Natural Characters* of *Vespa, Andrena, Apis*, &c.

(*l*) Tab. 2. * *, a fig. 1. *dd*, and b. fig. 2. *aa*.

(*m*) Tab. 11. * *. d. 2. α. fig. 1. *ff*.

(*n*) See his *Nat. Char.* of *Apis*.

(*o*) Entom. Syst. tom. 3. p. 307. under *Hylæus Morio*, and p. 343. under *Eucera longicornis*.

(*p*.) Tab. 11. ubi supra *e e*.

infernè

inferne includentes (*r*). To this if we add what he says elsewhere, "*Palpi antici maxillæ dorso adnati*," it will appear that his *maxillæ* are what I have termed *valvulæ* in the following work (*s*), and are also equivalent to the *valvæ* of the lower *vagina* of the Linnean character of *Apis*. In *Hymenopterous* insects these are longitudinal instead of transverse, and the term *maxilla* (jaw-bone) applied to a membrane is not a little absurd. In his *Natural Characters* of some genera in this class, Fabricius calls this part, with respect to the whole proboscis, "*linguæ lamina exterior*, or *lacinia exterior* (*t*).

PALPI ANTERIORES, sometimes called *antici*: these answer to my *palpi exteriores* (*u*), they emerge laterally from the *maxilla* or *valvula*.

PALPI POSTERIORES, sometimes denominated *postici*: they are equivalent to my *palpi interiores* (*x*), and sometimes arise from the tongue just above the top of the tube (*y*), and at others just below the apex of the *exterior laciniæ* (*z*). I have altered both these terms in conformity to the opinion of Professor Afzelius (*a*), upon whose accuracy the greatest reliance may be placed; and indeed the epithets *exterior* and *interior* are much more applicable to them, than *anterior* and *posterior*.

(*r*) Philos. Ent. c. ii. § 3. (*s*) Tab. 11. **. d. 2. α. fig. 1. *cc*.

(*t*) E. G. *Sphex*, *Bembex*, &c. *Andrena*, *Apis*, &c.

(*u*) Tab. 11. ubi supra *hh*. (*x*) Ibid. *ii*.

(*y*) Tab. 1. *. a fig. 3. *ll*. (*z*) Tab. 11. ubi supra.

(*a*) *Afzelius* in Lin. Trans. vol. 4. p. 250.

MANDIBULA. This is the *maxilla* of Linneus, and the present work, which professes to adhere as much as possible to the Linnean nomenclature.

CLYPEUS. This term is equivalent with *labium* of Linneus; and denotes a part which, by these insects, is used to answer the purposes of a lip. *Galea* might, with equal propriety, be applied to the dilated joint of the *tarsus* of *Sphex clypeata*, as *clypeus* to this part. Fabricius, indeed, himself, as well as his disciple Panzer, in their descriptions, have frequently used the term *labium*, not to signify the Fabrician, but the Linnean *labium* (b); of course I have employed this term instead of *clypeus* (c).

Having explained the terms employed by Fabricius, I shall now proceed to consider his characters of the class in question. When he published his *Genera Insectorum*, he, at the same time, constructed *Natural Characters* for the several classes under which at that time he had arranged them, but he neglected doing this for the new classes which he has since formed. It is, however, an excellent idea, and I mean to adopt it hereafter with respect to the *Hymenoptera*. His original *Essential Character* of his *Piezata* class, as I ob-

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(*b*) The former in his *Artificial Character* of *Bembex*, and in his description of *Hylæus cylindricus*, *albilabris*, &c. The latter in *Crabro* and *Nomada* often.

(*c*) Tab. 10. **. c. 2. δ. fig. 12. and fig. 13. *c*.

served above, was this: "*Palpi quatuor, maxilla cornea, compressa, sæpe elongata.*"

In his supplement to his *Entomologia Systematica* he omits the *palpi*, retaining only the last member of the character, perhaps with the view of rendering it less complex: but as the following class, *Odonata*, is distinguished by *palpi duo*, it seems to me no improvement to drop a character which certainly runs through the whole class, and which affords a more constant distinction than that which is retained. There appears to be no reference in this character to that of the *Synistata*, although both classes were originally united by our author. The first circumstance noticed in it is the substance of the *maxilla* or *valvula*. *Maxilla cornea*; this, generally speaking, holds good only with respect to the base of this part (*d*); the apex (*e*) is usually either wholly coriaceous, or partly corium and partly membrane. Nay, in nine of his genera (*f*), Fabricius describes this part as entirely membranaceous, so little consistent is he with himself. The term, by which he denotes the next circumstance he fixes upon to distinguish this class, *compressa*, should point out an obvious character, as it supplies him with its name. Yet I do not see how this term, if we understand it according to his own

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(*d*) Tab. 1. *. a. fig. 4. *a*. (*e*) Ibid. *b, c*.

(*f*) Viz. *Cynips, Sirex, Ichneumon, Evania, Tiphia; Nomada*. Gen. Ins. and *Banchus, Ophion,* and *Foenus*. Suppl.

definition (g), will well apply to this part. If confined to the base of the *maxilla* it will do in some cases, though not in all. The *apex* is usually either *plicatus*, *subplicatus*, or *concave*, so as to embrace and defend the tongue. At any rate the term is too obscure in its application, to be used as an index to point to what class any individual belongs. The last part of this character, *sæpe elongata*, is peculiar to *Apis*, I mean that of Linneus, and a very few other genera.

These observations, I think, will make it evident enough, that the characters, which Linneus has fixed upon to denote this class, are far preferable to those of Fabricius both for universality and notoriety.

I shall next proceed to notice the alterations introduced by this author into the genera. To those of Linneus he has added twenty-two. The whole are thus arranged: *Cynips, Tenthredo, Sirex*, Oryssus, *Ichneumon*, Banchus, Ophion, Foenus, Evania, Chalcis, *Sphex*, Pompilus, Larra, Tiphia, Scolia, *Chrysis*, Thynnus, Leucospis, Bembex, *Vespa*, Masaris, Mellinus, Philanthus, Crabro, Hylæus, Andrena, *Apis*, Eucera, Nomada, *Formica*, Dorylus, *Mutilla*. In this list the new genera are printed in Roman characters. Of these *Oryssus* is separated from *Sirex*; *Banchus, Ophion*, and *Foenus*, from *Ichneumon*; the first containing such *Ichneumons* as have a compressed subsessile abdomen, with an aculeus scarcely exerted(*h*); the next, those that have a falcated abdomen and very short aculeus(*i*); the third, such as are distinguished by filiform antennæ with not more than fourteen joints(*k*). *Evania* is taken from *Sphex*(*l*), as is the case likewise with *Chalcis*(*m*), *Pompilus*(*n*), *Scolia*(*o*), and *Philanthus*(*p*); *Bembex* consists of *Apes* and *Vespæ*(*q*); *Mellinus* and *Crabro* of *Spheces* and *Vespæ*(*r*); *Hylæus*, *Andrena*, *Eucera*, and *Nomada*, are separated from *Apis*(*s*); and *Dorylus* contains merely *Mutilla Helvola*. The parts from which he takes the *Artificial Characters* of his genera, are the *palpi*, *labium*, *maxillæ*, *lingua*, and *antennæ*.

(g) *Abdomen compressum; cujus diameter transversalis cedit verticali.* Philos. Ent. c. ii. § 12.

Fabricius seems to have made no attempt to improve upon the Linnean subdivisions of the genera, but to have adopted them as he found them, *Apis* only excepted, in which he drops them. In his *Entomologia Systematica* and its supplement, he has described 1207 species belonging to this class,

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(*h*) E. G. *Ichneumon venator*, Lin. (*i*) *I. luteus* and *pugillator*. (*k*) *I. jaculator*. (*l*) *Sphex Appendigaster*.

(*m*) *Sphex fissipes*. (*n*) *S. fusca, viatica, tropica*.

(*o*) *S. plumipes*, Drury 1. Tab. 44. fig. 5. (*p*) *S. arenaria*.

(*q*) *Vespa signata*, Lin. *Apis rostrata*, Lin.

(*r*) *Sphex mystacea* and *Vespa campestris* belong to *Mellinus*, and *Sphex cribraria* and *Vespa uniglumis*, &c. to *Crabro*.

(*s*) *Apis maxillosa, florisomnis*, &c. are *Hylæi*. *A. cærulescens, helvola*, &c. are *Andrenæ*. *A. longicornis* is a *Eucera*, and *A. variegata, Fabriciana*, &c. are *Nomadæ*.

Gmelin, in his edition of the *Systema Naturæ*, has attempted to unite Fabricius with Linneus, usually drawing the first member of his *Artificial Characters* from the *Natural Characters* of the former, and subjoining the *Artificial Characters* of the latter (*t*). His introduction of the *mandibula* (*maxilla* Lin.) is far from an improvement, as this part varies not only in the sexes, but often very much in the different families of the same genus (*u*). This author has made a great mistake in four instances in copying the characters of Fabricius, by representing all the *palpi* as attached to the *labium*, when, in fact, this is only the case with the *interior* ones (*x*). His *Essential Characters* exhibit a singular mixture of those of Linneus, Fabricius, and himself (*y*). I do not, however, entirely dissent from the method which Gmelin has pursued. Under certain restrictions, the introduction of the *labium* (*lingua*) at least, might add a constant character in many genera in this class. But upon

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(*t*) Fabricius, in the Preface to his Supplement, seems to allude to this: "*Instrumenta cibaria introduxi,*" says he, "*constantissima inveni, at nullo modo cum alis aliisque partibus jungenda. Mixta semper chaos præbent, et lacessitus demonstrationem suscipiam*. p. 1.

(*u*) Vid. Tab. nostr. ferè omnes.

(*x*) Viz. in *Ichneumon, Tiphia, Formica, Mutilla.*

(*y*) Thus he sometimes copies Linneus; in *Sphex* he mixes Fabricius with Linneus; in *Scolia, Thynnus,* and *Tiphia* he copies Fabricius. *Leucospis* mixes Fabricius with Gmelin, and *Chalcis* is entirely Gmelin; its character is taken from the antennæ only.

this head I purpose speaking more at large hereafter. Gmelin has considered the Fabrician genus *Evania* as a family of *Sphex*; *Bembex* and *Crabro* as subdivisions of *Vespa*; and *Andrena* and *Nomada* of *Apis*. The number of species noticed by him from various authors in this class is 1241, but the same insect, if I am not mistaken, often reappears under a new name.

It now remains that I offer a few observations upon the Linnean and Fabrician genera, so that, upon a comparison, the merits or defects of each may be readily perceived; and then conclude my remarks upon this class, by suggesting some improvements of which it seems capable.

Linneus has given only ten genera in this class. Of these, *Cynips*, *Tenthredo*, *Sirex* (z), *Chrysis*, *Formica*, and *Mutilla*, seem to be natural genera, that admit of little alteration. If those species were excluded from *Apis* and *Vespa*, which do not agree with Linneus's character, they would justly claim the same appellation. The present definition of *Ichneumon*, if we rigidly adhere to it, will exclude those legitimate Ichneumons that have not an exerted aculeus. This genus requires to have nearly the whole family of the *Minuti*, and some others separated from it. *Sphex*, as it now stands, is not a natural genus, but rather, like the *Elongata* family in *Chrysomela*, a receptacle for the rejectamenta of other genera. This genus wants to be thoroughly studied, it ought to be entirely taken to pieces and worked over again. Both its families contain a variety of insects that are at variance with each other, and its *Essential* and *Artificial Characters* are by no means well constructed. The former will agree with many insects that Linneus has described as *Vespæ* (*a*), and "*Antennæ articulis decem,*" in the latter, will apply to no *Sphex* that I have examined, without we suppose that he numbered only the joints of what I call the *Apex.* With respect to the other genera, this great author had selected discriminating characters, but he was not sufficiently attentive to these in the arrangement of species, so that individuals, toto cælo at variance with the character of a genus, are not seldom assigned to it. Had he bestowed that attention upon entomology that he did upon botany, his penetrating genius, provided it was furnished with sufficient materials, would have placed the *Genera Insectorum* upon the same admirable footing with the *Genera Plantarum*; but the botanical department absorbing his chief attention, only subordinate pains were bestowed upon insects: much, of course, was left to be done by those of his successors who directed their principal efforts to the improvement of entomology: the chief business of these is to extricate the natural genera.

(z) I know but few of the Linnean species of this genus, of course I cannot speak positively concerning it.

(*a*) *Vespa uniglumis, minuta,* &c.

Of all authors, Fabricius is the only one who has attempted much in this way. Let us now see how far he has succeeded. Of six of his new genera *Oryssus*, namely, *Larra*, *Scolia*, *Thynnus*, *Leucospis*, and *Dorylus*, it has never been my fortune to see a single species. *Scolia* and *Leucospis*, as far as I can form a judgment from figures, appear to be good genera. The former, from its thorax, retuse behind, and body usually hairy, I conjecture to have some affinity with *Mutilla*: the latter approaches near to *Chalcis*; its principal distinction is its aculeus reflected and laid upon the back of its abdomen (*b*). *Banchus* and *Ophion*, I think, are without sufficient reason separated from *Ichneumon*; but these may furnish a good hint for families in that genus. *Foenus*, especially if more species are discovered distinguished by the same peculiarities, may with propriety be considered as distinct. *Evania*, I have seen only *Evania Appendigaster* (*c*), I conjecture to be too nearly related to some of the *Pompili*. *Chalcis*, *Pompilus*, *Tiphia*, *Bembex*, *Philanthus*, and *Crabro*, would furnish, I apprehend, the Linnean entomologist a clue for the formation of an equal number of natural genera, but many species now considered as belonging to them should first be excluded (*d*).

(*b*) See Adams on the Microsc. Pl. 17. fig. 1, 2, 3.

(*c*) This singular insect has been taken in England, with several others equally rare, by the Rev. Jas. Coyte of Ipswich.

(*d*) E. G. I should regard all those species of *Bembex* as illegitimate that want the *Labium conicum*.

I have no other idea of *Masaris* than what I have gained from the *Masaris crabroniformis* of Panzer (*e*); but this species seems to differ from the rest in having reniform or lunar eyes, a circumstance which distinguishes several other insects without plicate wings, which might go with that into one genus, though they have usually been referred to *Sphex* or *Vespa*. *Mellinus* seems a good genus, and contains the genuine petiolated *Spheces*, and some of those that have no petiolus. It might be as well, perhaps, to distinguish this genus, or *Crabro*, by the name of *Sphex*. Upon the genera which Fabricius has taken from *Apis*, I shall have occasion to enlarge hereafter.

Having examined the *Instrumenta cibaria* of several individuals in many of the genera of this class, I shall now inform the reader in what respects the characters of Fabricius vary from those that I examined. In *Tenthredo*, with him the *palpi* are all filiform, and the *interior* triarticulate. In those that I inspected the *exterior palpi* are thickest in the middle (*f*); the *interior*, instead of three, consist of four articulations and are clavate (*g*). The *labium* he describes as cylindrical and trifid at its apex. Ours is rather flat with a tripartite apex (*h*). In *Ichneumon* the *exterior palpi* are said to be sexarticulate, and the *interior* quinquearticulate; the *valvulæ*

(*e*) Panz. Fn. Germ. Init. N° 47. Tab. 22.

(*f*) Tab. 14. N° 1. fig. 1. *h h.* (*g*) Ibid. fig. 2. *c.*

(*h*) Ibid. fig. 2.

are described as bifid and rounded at the apex; and the *labium (lingua)* cylindrical and emarginate. In such, *aculeo exerto*, as I have examined, the *exterior palpi* are quinquearticulate, with the second joint larger than the rest and trapeziform (*i*). The *labium* is cylindrical, but not, so far as I could discover, emarginate (*k*). In those whose *aculeus* is not exerted, the *palpi* are the same nearly as the other (*l*), but the tongue is semicylindrical, and the *valvulæ* are concave and truncate at the apex (*m*). His character of *Sphex* is probably taken from *Ammophila Vulgaris*. He gives the *interior palpi* as quinquearticulate, and the *labium* as depressed, cylindrical and emarginate at the apex. In all the *Ammophilæ* that I have examined, the *interior palpi* are quadriarticulate (*n*), the *valvulæ* have a semisagittate apex (*o*), and the tongue is tubular, clavate, and cleft at its summit, the fissure being much the deepest on the upper side (*p*). In *Tiphia* his character assigns five articulations to the *interior palpi*, and represents the *labium* as cylindrical. In *Tiphia femorata* the latter of these is flat (*q*), and the number of joints of the *interior palpi* never exceeds four in any genus in this class, at least as far as I have examined it. The *valvulæ* of his *Chrysis* are acute, mine has them obtuse (*r*):

(*i*) Tab. 14. N° 2. fig. 2. *c*. (*k*) Ibid. fig. 3. (*l*) Ibid. fig. 1. *d*. (*m*) Ibid. *e*, *c*. (*n*) Ibid. N° 9. fig. 1. *e*. (*o*) Ibid. fig. 3. *d*. (*p*) Ibid. fig. 2. (*q*) Ibid. N° 10. fig. 1. *b*. (*r*) Ibid. N° 6. *c*.

and its *interior palpi* consist of three (*s*), instead of four joints. In his character of *Pompilus* the *labium* is described as rounded, corneous, and entire; whereas, in *Pompilus viaticus*, that organ is trifid (*t*). He takes no notice of the callous tips which distinguish the lobes of the tongue in *Vespa* (*u*), and he calls the *valvulæ* acute, when they are rather rounded (*x*). Whether, by his *Philanthus*, he intends those *vespiform* insects, the sides of whose abdomen are crenate, of which Panzer has figured so many under that name (*y*), I am not certain, but if he does, his characters are very different from those of such species as I have examined: for the *valvulæ* instead of being bifid are entire (z), and the *labium* is not entire and rounded, but divided at its apex into two lacerato-ciliate lobes (*a*). The *valvulæ* in his genus *Crabro* are called bifid, and the *labium* obconic. In *Crabro cribrarius* the former are entire and rounded at the tip (*b*), and the latter is rather attenuated in the middle (*c*). From these remarks, we cannot avoid concluding, either that Fabricius is not altogether to be depended upon for accuracy, or

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(*s*) Tab. 14. N° 6. *e*. (*t*) Ibid. N° 4. fig. 2. (*u*) Ibid. N° 8. fig. 1. *cccc*. (*x*) Ibid. fig. 2. *b*. Kirby in Lin. Trans. vol. 4. p. 212. Tab. 19. N° 4. fig. 1. (*y*) E. G. *Philanthus semicinctus*, N° 47. Tab. 24. *P. hortorum*, N° 63. Tab. 9. &c.

(z) Tab. 14. N° 7. fig. 1. *a b*. (*a*) Ibid. fig. 2. (*b*) Ibid. N° 5. fig. 2. *b*. (*c*) Ibid. fig. 1. *b*. and De Geer, tom. 2. Pie. 2. Tab. 25. fig. 12. *e*.

that the *Instrumenta cibaria* vary too much in the same genus, to be assumed as a constant and certain criterion.

I know no reason why that liberty should be denied to the entomologist, which is allowed to the botanist, of forming new genera as occasion shall demand, provided this be done upon good grounds, and with due caution and judgment.

——— hanc veniam petimusque damusque vicissim.

That inundation of non-descript species which, since the time of Linneus, has overflowed the European Cabinets, renders it a work of charity to spare the entomologist the Herculean labour of going over the definitions of perhaps several hundred species before he can determine one. This can only be effected by the formation of new genera and families; and here, I think, a middle course ought to be steered between Linneus and Fabricius. The former having confessedly too few genera, and the latter having multiplied them beyond necessity, and mistaken the characteristics of families for the indications of genus. But, in the construction of genera, from what parts are we to draw our characters? With Fabricius, are we to confine ourselves to the *Instrumenta cibaria et antennæ?* Or with Linneus and his followers, are we to take them indifferently from any part that will furnish them?

In botany, to draw the characters of classes and genera from the fructification alone is highly proper, for in this consists the essence of the plant. To nourish and bring this to maturity the root sends its fibres downwards, the stem shoots upwards, the branches put forth, and the leaves unfold. But the *proboscis* and *maxillæ* do not constitute the essence of the insect. On the contrary, the head and its organs are in some degree analagous to the root in plants, for they collect and absorb the nutriment; the truncus may be looked upon as representing the stem, the limbs the branches, the wings the leaves, the abdomen as a kind of calyx, including the fructification. Therefore, the great command, "increase and multiply," will direct us to those parts which constitute the essence of an insect; but these, if it were possible, it would be improper to use for characters (*g*). Since then the *Instrumenta cibaria* do not constitute the essence of an insect, it is consequently a matter of indifference whether the generic characters be taken from them, or other parts that are more obvious (*h*). In these small animals, I call that a generic character which is constant through a genus from whatever part it be taken. In some classes those

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(*g*) *Genitalium curiosior indagatio abominabilis displicet quamvis varia et singularis, ——— quæ tamen posset ad ordines naturales viam monstrare.* Lin. de Mammalibus.

(*h*) In the *Mammalia* the teeth are easily examined, and therefore, if constant, afford good characters. Nor do I pretend to say that the *Instrumenta cibaria* of insects, assumed under proper limitations, might not afford such as were equally good, if they were equally easy of inspection.

those parts distinguish the class, which in others are peculiar to certain genera. Thus, in the *Coleoptera*, the variations, with respect to number of joints, in the *tarsus*, will serve as an excellent characteristic of many genera, which, as they now stand, are not sufficiently discriminated (*i*); while, in the *Hymenoptera*, the same number obtains in every genus. Again, in the same class, characters, which in some genera are constant and proper generic diagnostics, in others vary in the several families, and even in subdivisions of the same family. Thus, in most *Hymenopterous* genera, the number of the articulations of the *palpi* is constant, while in *Apis* it varies continually. Fabricius, had he been aware of this circumstance, would have divided this into more genera than he has done. This observation shews the fallacy of his assumption, that the *Instrumenta cibaria* afford constant characters. The *labium* or *lingua* is the only one of his diagnostics, that, as far as I have examined it, does not vary in the same genus; and therefore, where it may be readily inspected, it will furnish an excellent one. Linneus has excluded this part and

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(*i*) The present character of *Chrysomela*, for instance, is at variance with a large number of species that are arranged under it; but if the number of articulations of the *tarsi*, which is constant in the genuine *Chrysomelæ*, was added to its character, it would furnish a clue to distinguish the true from the false, and be a great improvement. The same observation will apply to *Tenebrio*.

its *vagina* from most of his genera, either under the name of *lingua* or *proboscis*; but this is contrary to fact, for all *Hymenopterous* insects are furnished with a *proboscis* consisting of the following parts, viz. a central *tongue* defended by two *valvulæ*(*k*), laterally palpigerous(*l*), and a *tube*(*m*), just above the apex of which, or from the *exterior laciniæ* the *interior palpi* emerge(*n*). This part, though not equally conspicuous in all, exists in all; and its mere direction, whether it is inflected or not, can make no difference as to its title to the name of *proboscis*. In *Apis*, *Ammophila* (*o*), the genuine *Vespæ*, *Philanthus*, *Crabro*, many *Spheces*, *Chrysis*, and *Tenthredo*, this part may be examined with as much ease as the *Instrumenta oris* of the *Diptera*. But in *Cynips*, *Ichneumon Tiphia*, *Formica*(*p*), and the petiolated *Spheces*(*q*), it is not so readily inspected, nor, in these, is it easy to get a distinct idea of it, unless it be nicely extracted from the head of the insect, and put under a strong magnifier.

In the construction of the *Essential Characters* of the genera in this class, the form of the tongue, where sufficiently conspicuous, might be added to

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(*k*) Tab. 11. **. d. 2. *α*. fig. 1. *g*, *c c*. (*l*) Ibid. *h h*.

(*m*) Ibid. *d*. (*n*) Tab. 1. *. a. fig. 3. *bb*. & Tab. 11. ubi supra; *i*.

(*o*) I have ventured to separate *Sphex sabulosa* and its affinities under this name from *Sphex* in a paper published in the fourth vol. of the Linnean Transactions, to which I refer the reader. Vid. p. 195. (*p*) De Geer, tom. 2. P^{ie}. 2. Tab. 41. [illegible] (*q*) Tab. 14. N° 3.

the aculeus, and it might be placed at the head of the *Artificial Character*, in the formation of which recourse may likewise be had, where they are constant to the *palpi* (r), the *valvulæ* (s), the *eyes* (t), the *antennæ* (u), *collum* (x), *thorax* (y), *wings* (z), *thighs* (a), *abdomen* (b), its *petiolus* (c), and the *aculeus* (d).

I shall now throw out a few hints concerning some improvements of which the characters of the different genera in this class seem capable. With respect to *Cynips*, after excluding the first member of the Linnean *Artificial Character*, which is partly common to the whole class, and partly not true, there will remain only the *aculeus*. To this I would add the following circumstances, which distinguish all the species of the genus that I am acquainted with.

CYNIPS. *Lingua* inconspicua.
Antennæ filiformes articulis 15. (*Geoffroy*) (e).
Alæ subvenosæ.
Abdomen compressum subtùs carinatum. (*De Geer*).
Aculeus spiralis sæpius reconditus. (*Linneus*).

(r) *Sirex*, *Ichneumon*, &c. (s) *Ammophila*. (t) *Vespa*, &c. (u) *Ichneumon*, *Cynips*, &c. (x) *Ammophila*. (y) *Mutilla*. (z) *Vespa*, &c. (a) *Chalcis*. (b) *Chrysis*, *Philanthus*. (c) *Formica*. (d) *Cynips*, *Tenthredo*, *Sirex*.

(e) Geoffroy says 14, but I have included the radicle, or minute joint which unites them to the head.

The three intermediate members of this character will distinguish the species of this genus from the minute *Ichneumons*, some of which approach very near to it, and are furnished with the *Aculeus spiralis reconditus* (*f*). The character of *Tenthredo* seems to require no material alteration; I would only insert, instead of the first member of the Linnean definition,

Lingua apice tripartita.

The genus *Ichneumon*, as it now stands, admits of considerable improvements, for its present character is at variance with innumerable species that are arranged under it. The *Minuti*, for instance, for the most part, have not half thirty joints in their antennæ, and most of them, as well as many of the other families, are not distinguished by the *Aculeus exertus*, and *Abdomen petiolatum*. In settling the species of this genus, Linneus seems to have been led merely by their economy, and to have looked upon all those as *Ichneumons*, which were found to deposit their eggs in living insects. But is it not at once giving up all system to make economy and *habitat* take place of those characters which nature has impressed upon her genera? Indeed we know too little of the economy of these insects, to say that it is the same in all, or even that it is not materially different, and with respect to their *habitat*, although it is in living insects, yet it is subject to considerable variations, which may furnish a

(*f*) Lin. Trans. vol. 5. p. 111. Tab. 4. fig. 5.

ground for distinctions; as for instance, whether they inhabit an insect in its first, second, or third state, or its eggs only; and again, upon what class they make their attacks. We never think of putting together into one genus those insects that prey upon dead animals, or live in dung, or upon the same plant. This is going back to the old entomologists who made *Habitat* a generic character (*g*). Many of the *Ichneumones Minuti* are likewise distinguished by another remarkable character, their wings are without veins. They vary much as to the form of their antennæ, in some these are ramose; in others filiform; in others again clavate; in a few capitate; and I possess one or two species in which they are curiously ornamented with *verticilli* of hairs. Whether these might be divided into more than one natural genus I cannot say, as I have not sufficiently studied them to offer any decided opinion upon the subject; with respect to their place in the system, I think they ought to follow *Cynips*, to which they are nearly allied: I mean if that genus continues at the head of the class. As to those which may be considered as genuine *Ichneumons*, I am not, as yet, sufficiently conversant with them to venture any other remark, than that those whose aculeus is not exerted, have the tongue, in such as I have examined, as I observed above, semicylindrical, and the *valvulæ* truncate at the apex; whereas those whose aculeus is exerted,

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(*g*) Rai. Hist. Ins. App. p. 378.

are distinguished by a cylindricical tongue, and *valvulæ* rounded or obtuse at their tips. Such petiolated *Spheces*, as I look upon to be genuine, have a tongue similar to the former of these *Ichneumons*, and the second joint of their *exterior palpi* is also rather trapeziform (*h*), but their economy, antennæ, general form, and habit, are very different. *Chalcis*, which, as well as *Leucospis*, is distinguished by incrassated posterior thighs, should, in my opinion, follow the *Ichneumones Minuti*, and be followed by *Leucospis*. I have not, however, by any means wholly made up my mind upon the natural juxta-position of the genera in this class, and therefore I shall not further commit myself upon that subject. *Pompilus*, by which I understand *Sphex viatica* of Linneus and its genuine congeners, is not only distinguished by a trifid tongue, with a hairy spot on each of its lateral lobes (*i*), but its antennæ also are revolute and setaceous, and its eyes lateral and oval. *Crabro* has a prismatical head, with large ovate or subtriangular eyes which almost meet above the mouth (*k*), with reticulations visible to the naked eye; its nose is usually covered with golden or silver pile: just above this the antennæ are inserted, so as to be properly defined by the term *anteriores* or *anticæ*. *Philanthus*, of Panzer at least, is remarkable, not only for its bifid tongue with lateral hairy eleva-

tions,

(*h*) Tab. 14. N° 3. (*i*) Ibid. N° 4. fig. 2. *c c*.

(*k*) De Geer, tom. 2. P^ie^. 2. Tab. 25. fig. 11. *y y*.

tions, but the sides of the abdomen are always crenate, its eyes are lateral and oval, and its antennæ subclavate. No genus is more evidently distinct from all others than *Chrysis*. The antennæ are spiral, and, excluding the radicle and scapus, fusiform. *Anus dentatus*, ought to be thrown out of the *Artificial Character*, as many species want it, but it would form a good characteristic for a family. The tongue of these insects is emarginate (*l*). The Linnean character of *Vespa* is very good, but instead of *Os maxillis absque proboscide*, *Lingua quadriloba* ought to be prefixed. This circumstance, in conjunction with *Alæ plicatæ*, distinguishes this from every other genus. *Masaris* may be known by its reniform eyes, subclavate antennæ, wings not plicate, and body linear and very narrow. *Tiphia*, by which I understand *T. femorata*, Fab. and its congeners, has fusiform anterior antennæ, and a very short obtuse tongue. The character of *Formica* requires some alteration, for the *squamula*, as De Geer has well observed, is the character of a family and not of a genus (*m*); this, to include all, might be altered to *abdominis petiolo nodoso*. I know too little of the genus *Mutilla* to say much concerning it: but pubescence, I think, ought, if possible, to be excluded from its *Artificial Character*, and the apterous *Ichneumons* should be omitted. The antennæ of the few that I am acquainted with are like those of *Chrysis*.

(*l*) Tab. 14. N° 6. (*m*) De Geer, tom. 2. P^ie. 2. p. 1042.

Linneus, as observed before, thought of dividing the class into two orders, * *Aculeo miti*, ** *Aculeo punctorio*. I have been stung, however, pretty severely by one of those *Ichneumons* whose aculeus is recondite, which genus is placed in the first, and on the other hand, many insects which are put into the second, are perfectly harmless in this respect; for instance, the aculeus of *Chrysis* is flexile and can make no puncture. In fact, the term *punctorius*, when applied to the aculeus of these insects, must be regarded as relative, implying, not that it can make no puncture at all, but merely that it cannot penetrate the skin of the human body, for all can make a puncture in such substances as are proper to receive their eggs. The *tibiæ* of *Hymenopterous* insects are armed with minute *spines*, from the variations of which, it is possible characters might be drawn for good orders in this class. Thus, for instance, the tips of all the *tibiæ* in *Tenthredo* are armed with two spines; in *Ichneumon*, the anterior have one only, and the others two; in *Apis*, the two posterior have two, and the four anterior one; and in *Formica* all the *tibiæ* are armed with a single spine only. These distinctions, I believe, have not before been noticed, but whether such orders would be natural or artificial, I am not prepared to say.

From this account of the origin, progress, and present state of the *Hymenoptera* class, it will appear sufficiently evident, that though the class itself is natural and well defined, yet the known species are not as yet all distributed into natural genera. To discover a natural genus is, however, no very difficult task. Insects that agree in habit are soon detected, and when these are placed together, an attentive comparison of them, and inspection of their parts, will soon enable any philosophical entomologist, especially if he has any knowledge of their general economy, to trace out those common characters which nature has inscribed upon such as are nearly related. The connecting links between two proximate genera, which usually borrow their characters from both, will give some trouble, but if he follow the lead of the *Essential Character*, "*Notam generi maximè propriam tradens*," he will not be long at a loss to which he is to refer any species of this description.

In order to shew what may be done in this class, I shall, in the following pages, endeavour to divide into natural genera and families the numerous species of the Linnean genus *Apis*; such, I mean, as are natives of this country, including *Hylæus*, *Andrena*, *Apis*, *Nomada*, and *Eucera* of Fabricius: but I shall previously conclude these introductory remarks with some account of what has been done in it by my predecessors.

Before the time of Linneus, naturalists seem to have had little or no idea of constructing generic characters. In the present class, however, as before observed, Ray has attempted this, and with as much success as could be expected. The *Apes* that come under that subdivision of his *Tetraptera*, which he denominates *Gregaria et Favifica*, he considers as forming a distinct section, which he names *Mellifica*; this he divides into what may well be called two genera: viz. *Apis*. Corpore longiore, angustiore, et glabriore. *Bombylius*. Corpore breviore, latiore, et hirsuto. These, probably, gave Linneus the hint for his two families. Ray seems to have paid particular attention to this genus, and has described several species with great accuracy.

Of the other predecessors of Linneus, I shall mention only that illustrious French naturalist Reaumur, to whom this genus is under greater obligations than to any entomologist who either went before or succeeded him. To him nature lifted up the veil that covers her awful face, and was delighted to initiate him into her most secret mysteries. Though not strictly a systematist, he has enriched his great work with innumerable facts and observations, which may be made of the greatest use to the systematical naturalist. He did not usually construct generic characters, but in separating his *Proabeille* from *Apis*, he laid a foundation for the division of this genus into two natural genera(*n*).

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(*n*) "Peut-etre," says he, speaking of one of these, "qu'elles doivent être mises dans un genre particulier, qui auroit le nom de *Proabeilles*. Leur trompe differe par quelques particularités de

To pass by his admirable history of the hive bee, a considerable portion of his sixth volume is devoted to the wild species of the genus *Apis*, which he divides into seven families, according to their several modes of nidification, as follows:

I. *Bourdons*. These construct their nests of moss. They are what I call *genuine Bombinatrices*(*o*).

II. *Des Abeilles Perce-bois*. These form curious cells one above another in wood. They may be called *false Bombinatrices* (*p*).

III. *Des Abeilles Maçonnes*. These make their nests of a kind of mortar, composed of agglutinated particles of sand or earth (*q*).

IV. *Des Abeilles coupeuses de feuilles*. The nidi of these are curiously formed of the leaves of trees, rolled up into a kind of cartridges (*r*). This, with the preceding division, belongs to my family of the genus *Apis*, "*Labio inflexo elongato*."

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de celle des mouches à miel: elle est en grande partie renfermée dans un étui écailleux, et cylindrique: le bout de la trompe sort de cet étui, et est accompagné de quatre filets analogues aux quatre demi-fourreaux des autres trompes, mais autrement construits; ils paroissent grainés. D'ailleurs au lieu que la trompe des abeilles, lorsqu'elle est dans l'inaction a son bout tourné vers le col, le bout de la trompe de ces *Proabeilles* se trouve sous les dents." Mem. 6. p. 96. Tab. 9. fig. 6, 7. Reaumur here mistakes the *palpi* for something analogous to the *valvulæ* and *laciniæ*.

(*o*) Ibid. Mem. 1. (*p*) Ibid. Mem. 2. (*q*) Ibid. Mem. 3.
(*r*) Ibid. Mem. 4. p. 97. usque ad fin.

V. *Des Abeilles qui creusent la terre pour y faire leur nids.* This order, the individuals of which construct their cells in little burrows, which they excavate in banks, pathways, &c. contains both genuine *Apes* and *Proabeilles*, (*Melitta*, K.) (*s*).

VI. *Des Abeilles dont les nids sont faits d'especes de membranes soyeuses.* The insects that nidificate in this manner, belong to the first family of my genus *Melitta* (*t*).

VII. *Des Abeilles Tapissieres.* These insects excavate burrows in hard pathways, and line their little apartments in a most curious manner with the petals of the common poppy. I do not know that we have any of them in England (*u*).

Of these, the first, second, third, fourth, and sixth, are natural families, or subdivisions of families; but the fifth contain species not only of different families, but genera. Thus we see this great author, without any hypothesis in view, but solely by following nature, has furnished us with a clue for the construction of five natural subdivisions in the genus *Apis*. This was doing a great deal before a genuine generic character had been formed. Bazin, a French author, or rather compiler, for he seems to have done little more than abridge Reaumur, has altered the names of some of his families,

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(*s*) Ibid. ad p. 97. (*t*) Ibid. Mem. 5. ad p. 139.
(*u*) Ibid. a. p. 139. usque ad fin.

and left out the fifth. The *Perce-bois* he calls *Menuisieres*, and the *Bourdons*, *Cardeuses* (*x*).

Linneus's characters of this genus, as they stand in the last edition of the *Systema Naturæ*, are these:

APIS. *Character Essentialis.*

Aculeus punctorius: lingua inflexa.

Character Artificialis.

Os maxillis atque proboscide inflexâ, vaginis duabus bivalvibus.

Alæ planæ in omni sexu.

Aculeus feminis et neutris punctorius, reconditus.

This character will exclude more than half those insects which Linneus and many other authors have regarded as belonging to this genus, and at the same time admit *Sphex sabulosa* and its congeners, (*Ammophila*, K.) for the *proboscis* of the former, when not exerted, instead of being inflected, points to the maxillæ, and the terms, "*Proboscide inflexâ vaginis duabus bivalvibus*," will apply to the latter with stricter propriety than to most genuine *Apes*; for in these, the *Nomadæ* excepted and another small family (*y*), one of the two *vaginæ*, if we may denominate it by that term, is in fact *quadrivalvis* (z).

(*x*) Abregé de l'Histoire des Insectes pour servir de suite a l'histoire naturelle des Abeilles. A Paris, 1747.

(*y*) Tab. 5. *. b. fig. 3. Tab. 4. Apis *. a. fig. 4.

(*z*) Tab. 5. **. a. fig. 5. *bb*, *cc*. Tab. 10. **. d. 1. fig. 2. *aa*, *bb*. Tab. 13. **. e. 2. fig. 1. *ff*, *gg*.

After this great naturalist had separated *Sphex*, *Chrysis*, and *Vespa* from this genus; he divided it into two families, viz. * *Apes propriè dictæ.* ** *Bombinatrices hirsutissimæ.* But, as the learned Scopoli well observes, " *Sonus et hirsuties, in his speciebus gradatim aucta, incertos reddit ordines inde petitos* (*a*). And, in fact, authors, misled by the mere circumstance of hirsuties, have inserted species into this family that have no pretensions to affinity with it: an error, which Linneus himself has not avoided; for *Apis violacea*, *æstuans*, &c. are not genuine *Bombinatrices*, as will be proved at large hereafter.

Considerable attention has been paid to this genus by Scopoli, and he seems to have exerted himself not a little to set it upon a good footing. With what success we shall now consider. In his *Entomologia Carniolica* he assigns to it the following characters:

APIS. *Character Essentialis.*

Os rostro deflexo bivalvi.

Character Artificialis.

Rostrum porrectum, inflexum, mellisugum, bivalve 1—3 setum.

He takes his families in this work from the antennæ, viz. * *Antennis rectis.* ** *Antennis basi infractis.* Discovering, afterwards, the insufficiency of these characters to include all the species with

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(*a*) Ent. Car. p. 298. Note †.

which he was acquainted, in his *Annus historico-naturalis quartus*, he divides *Apis* into three genera, and entirely omits his families, the characters of which, in fact, are only sexual distinctions. These three genera he names *Eucera*, *Apis*, and *Nomada*, and distinguishes them by the following characters:

EUCERA. *Rostrum* 1. *Siphunculo* medio attenuato.
2. *Setulis* binis margine glabris siphunculo brevioribus.
3. *Valvis* duabus convergentibus glabris.
4. *Laminis* binis, dicta organa protegentibus, basi coarctatis, ibique palpum setaceum e latere educentibus.

Before I make any observations upon this character, I must point out what parts, the terms used in it, denote. The *Siphunculus* answers to the *labium* of Fabricius and my *lingua* (*b*). The *Setulæ*, to the *linguæ setæ*, or *linguæ laciniæ interiores* of that author, and to my *laciniæ interiores* (*c*). The *valvæ* to his *labii laciniæ laterales*, or *exteriores*, and to my *laciniæ exteriores* (*d*). And the *laminæ*, to his *maxillæ* and my *valvulæ* (*e*).

The genus *Eucera* is intended to include such *Apes* as are distinguished by antennæ as long as the body, e. g. *Apis longicornis*, Lin. &c.; but I shall

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(*b*) Tab. 11. **. d. 2. α. fig. 1. *g*. (*c*) Ibid. *ff*.
(*d*) Ibid. *ee*. (*e*) Ibid. *cc*.

shall shew hereafter that this circumstance characterizes the male only. The number and description of the parts of the *proboscis* does credit to the accuracy of this great author; but the *setulæ*, at least in *A. longicornis*, are not "*margine glabræ*," for, if they are examined under a good magnifier, they will be found to be ciliate on one side (*f*). He takes only the *apex* of the *valvulæ* for his *laminæ*, for he describes them as "*basi coarctatæ et palpigeræ*;" when, in fact, if the entire *valvula* be separated from the *proboscis*, it will be found narrowest in the middle, with a feeler emerging from its lateral sinus (*g*). In other respects, this character is most accurate, and if he had examined the *proboscis* in his next genus with equal accuracy, he would have discovered the same number of parts, although not retaining the same proportion with respect to each other.

APIS. *Rostrum* 1. *Siphunculo* medio.
2. *Valvis* binis siphunculo brevioribus.
3. *Laminis* binis palpigeris.

This character is also accurate as far as it goes, but in it he omits the *laciniæ interiores*, answering to the *setulæ* of his *Eucera*, which distinguish all genuine *Apes*, though in some they are not easy to be discovered (*h*).

(*f*) Tab. 10. **. d. 1. fig. 3. *c*. (*g*) Ibid. fig. 1. *d*.

(*h*) Tab. 13. **. e. 2. fig. 1. *ff*.

NOMADA. *Rostrum* 1. *Siphunculo.*
2. *Valvis* binis sub apice palpigeris.

This character seems designed for those insects, which Reaumur has called *Proabeilles,* and De Geer *Nomadæ.* It is by far the most imperfect and faulty of the three; for the flat short tongue of these scarcely merits the name of *siphunculus* (*i*), the *interior palpi* are passed over without notice, and that part which really answers to the *laminæ* in his other genera (*k*), is here designated by the term *valva.* In this genus the *valvulæ* are usually, but not invariably, "*sub apice palpigeræ.*" For want of due examination of the *proboscis,* he has inserted into this genus, under the name of *Nomada ruficornis,* a genuine *Apis.*

Geoffroy follows Scopoli, he distinguishes his *Apis* by the following characters:

APIS. *Antennæ* fractæ articulo primo longiore.
Os maxillosum linguâ membranaceâ inflexâ.
Aculeus ani simplex subulatus.
Abdomen petiolo brevissimo thoraci connexum.
Ocelli tres.
Corpus villosum.

These characters are the same, word for word, as he has assigned to the preceding genus (*Vespa*), with the sole exception of "*Corpus villosum*" in-

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(*i*) Tab. 2. **. a. fig. 1. *c.*

(*k*) Ibid. *bb.* & fig. 2.

stead of "*Corpus glabrum*." The first member of this character is often only a sexual distinction. The second is partly common to the whole class, and partly peculiar to genuine *Apes*. With respect to the third, the *aculeus* of all *Hymenopterous* insects, as far as I have had an opportunity of examining them, consists of the same parts, viz. two *valves*(*l*), and a central *vagina*(*m*), exerting a pair of *spicula*(*n*) barbed or serrated more or less on one side. In most genera the *aculeus* when unemployed is recondite, or withdrawn within the abdomen, but in a large proportion of the *Ichneumons*(*o*), *Sirex*(*p*), &c. both *valves* and *vagina* are exerted. So that the term "*simplex*" cannot with propriety be applied to one *aculeus* more than another. "*Subulatus*" very properly defines the *vagina* of the *spicula* of an *Apis*. The next member of the character is common to many genera; the fifth to the whole class; and the last excludes all those *Vespiform* bees (*Nomada*, Fab.) which evidently belong to this genus. This author adopts the families of Linneus.

De Geer's definitions of the two genera, into which, after Reaumur, he divides *Apis*, are now to be considered, they are as follows:

(*l*) Tab. 13. fig. 27. *b b*. fig. 28. *a a*. (*m*) Ibid. fig. 27. *a*. 28. *c*. and 29. (*n*) Ibid. fig. 28. *b b*. and 30, 31.

(*o*) Marsham in Linn. Trans. vol. 3. p. 29. Tab. 4. fig. 5.

(*p*) Reaum. tom. 6. Mem. 9. Tab. 31. fig. 3. *f f t*.

APIS. *Antennæ* fractæ articulo primo longiori.
Os dentibus et rostro flexili fracto, sursumque plicato.
Alæ planæ.
Abdomen thoraci petiolo brevi adnexum.
Aculeus punctorius in abdomine reconditus,
Oculi reticulati ovales integri.

NOMADA. *Antennæ* clavatæ vel filiformes articulis duodecim.
Os dentibus et rostro porrecto vaginâ cartilagineâ cylindricâ.
Alæ planæ.
Abdomen petiolatum.
Aculeus punctorius in abdomine reconditus.
Oculi reticulati ovales uniti.

The antennæ in both these genera, except in the two first families of *Apis*, are usually subclavate (*q*) in one sex, and filiform in the other; those of the male consisting of fourteen joints, including the radicle (*r*) or minute joint that unites them to the head, and thirteen in the females and neuters. The wings likewise, the petiolus of the abdomen, which is extremely short, the aculeus, and eyes are nearly the same in both genera. The second member of the definition constitutes their essential distinction,

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(*q*) The definition of *antennæ clavatæ*, in the *Fundamenta Entomologiæ*, is, *quæ versus apicem sensim incrassatæ*, and yet this term is often employed, and even by Linneus himself, for *antennæ capitatæ*.

(*r*) Tab. 1. *. a. fig. 8. *a*.

distinction, but one of the terms employed, to my understanding at least, does not convey a clear idea, for I do not perfectly comprehend what is meant by "*Rostrum sursum plicatum.*" In genuine *Apes* the *proboscis* is folded, as it were, in three lengths, with two elbows, so as, in the act of folding, to form the letter Z(s), the inflected end of the tongue constituting the exterior fold (t), and the *lora* the interior (u); and consequently there is a fold above, or between the middle fold and the head, as well as one beneath it. This is the only sense I can make of it: and, thus understood, it gives a good character of one difference between these genera, but not the best and most obvious: it might, I think, be better expressed *sursum et deorsum plicatum.* "*Rostrum porrectum,*" the term employed to express the peculiar character of *Nomada,* must be understood to signify that the first motion in unfolding the *proboscis* is to push it forwards beyond the mouth and maxillæ (x), whereas in *Apis* it is to unbend the lower fold (y). I shall hereafter have occasion to employ this term in the same sense.

Having considered what has been done in this genus by the predecessors of Fabricius, I shall next call my readers attention to the alterations introduced into it by that celebrated entomologist, and upon this head I must be more than usually particular,

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(s) Tab. 13. fig. 2. (t) Ibid. *dd, ff, g.* (u) Ibid. *bb.*

(x) Tab. 3. **. b. fig. 1. (y) Tab. 13. fig. 2. *dd, ff, g.*

ticular, for this genus appears to me capable of furnishing the best of all possible criterions for the trial of his system. The *instrumenta cibaria* are so conspicuous in most of the species that compose it, and so easy to be examined, that if he has made any mistake of consequence in the characters of this genus, it is evident that dependance cannot be placed upon those which he has assigned to others, where the organs, upon which he builds his system, are less obvious. It is not allowable to adopt, as a gratuitous assumption, that these organs are not subject to variation; and so to construct characters from them, as they appear in one or two species only, trusting solely to habit for the arrangement of the rest: but the several results of a careful inspection of them, in as many different individuals as possible, taken from all the subdivisions of a genus, should be attentively considered and compared, and the agreement and disagreement of them accurately noted. This is the only sure ground to go upon, and thus alone can it be ascertained whether any, and which, of these organs supply characters that are certain and constant. It will soon appear that Fabricius has not taken these pains with respect to those genera into which he has divided *Apis*. These are *Bembex*, *Hylæus*, *Andrena*, *Apis*, *Eucera*, and *Nomada*.

The first of these, *Bembex*, I shall pass by, as it consists chiefly of insects taken from *Vespa*, and includes only one Linnean *Apis*, which, as far as I can

I can learn, has never been taken in England(z), and begin with *Hylæus*, which follows it.

HYLÆUS. *Character Naturalis.*

Os maxillis, palpis, linguâque inflexâ trifidâ.

Palpi quatuor, inæquales, filiformes.

Anteriores paulò longiores, sexarticulati, articulo secundo paulò longiori, adhærentes maxillæ dorso.

Posteriores breviores, quadriarticulati, adnati laciniis exterioribus labii sub apice.

Mandibula cornea, arcuata, inermis.

Maxilla brevis, cornea, fornicata, apice rotundata.

Labium elongatum, basi corneum, compressum, in medio flexum, trifidum; laciniis exterioribus corneis, compressis, sub apice palpigeris; intermediâ membranaceâ, planâ, emarginatâ.

Antennæ cylindricæ.

(z) *Apis rostrata*, Lin. In some M. S. notes in an interleaved copy of the *Systema Naturæ*, which belonged to the celebrated Mr. Gray, it is observed by Miller upon this species, "*In Angliâ inveniri audio.*" But as this is only hearsay evidence, it may very possibly be a mistake. I have never seen it in any cabinet of English insects.

Character Artificialis.

Os maxillis, palpis, linguâque inflexâ, trifidâ.
Maxilla brevis cornea.
Labium in medio inflexum, trifidum laciniâ mediâ emarginatâ.
Antennæ cylindricæ.

The species arranged by Fabricius under this genus belong to three distinct and natural families, two of which I consider as forming a part of my genus *Melitta*, (*Proabeille*, Reaum. &c. *Nomada*, Scopoli and De Geer) and the species of the other as genuine *Apes*. *Hylæus annulatus* belongs to one family of the former; *H. cylindricus, quadricinctus, flavipes, albipes*, &c. are males of another; and *H. truncorum, maxillosus*, and *florisomnis* are genuine *Apes*. Now these three families differ very materially in their *Instrumenta cibaria*, as may easily be seen by comparing the sets of figures referred to below (*a*). The question therefore is, from which of them Fabricius drew his characters? With respect to the *anterior or exterior palpi* of six articulations, they are one characteristic of the former genus, for in the *Apes* included in *Hylæus*, they consist only of two (*b*). The *posterior or interior palpi*, he describes as consisting of four articulations, and as springing from the *exterior laciniæ* of

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(*a*) Melitta, Tab. 1. *. b. Tab. 2. **. b. Tab. 3. **. b. Apis, Tab. 9. **. c. 2. γ.

(*b*) Tab. 9. **. c. 2. γ. fig. 4. *b*.

of the *labium* (or tongue) a little below their apex. Now this is a circumstance that takes place, not only never in these families, but likewise not in any one of the five genera into which he has divided *Apis*. For where the *palpi* emerge from the exterior *laciniæ*, as they most commonly do in *Apis*, but never in *Melitta*, two is the most natural number of their articulations(*c*), but in the subdivision to which *Hylæus florisomnis* and its affinities belong, they are exarticulate(*d*). In *Melitta* they invariably consist of four joints, but in that genus they spring from the tongue itself, a little above the apex of the tube(*e*). The *mandibulæ* or *maxillæ*, are *inermes* or *edentulæ*, only in one sex of these families of *Melitta*(*f*); but, in the *Apes* in question, they are bidentate at the apex in all the sexes(*g*). The *maxillæ* or *valvulæ* are corneous only at their base, their tops are coriaceous; they can scarcely be denominated "*breves*" in any of these families(*h*), and in two of them they are acute instead of being rounded at the apex(*i*). The characters he has assigned to the *labium* or *lingua* will not entirely agree with it in any one of them. In the *Apes* in question it is elongate,

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(*c*) Tab. 6. **. b. fig. 3. *b*. Tab. 12. **. e. 1. neut. fig. 4.

(*d*) Tab. 9. **. c. 2. γ. fig. 3. *dd*. and fig. 5. *b*.

(*e*) Tab. 1. *. b. fig. 1. *ee*. (*f*) Ibid. fig. 5, 6, 7. Tab. 3. **. b. fig. 3, 4. (*g*) Tab. 9. **. c. 2. γ. fig. 6. (*h*) Tab. 1. *. b. fig. 2. Tab. 3. **. b. fig. 2. Tab. 9. ubi supra fig. 3. *a*.

(*i*) Viz. Tab. 1. *. b. and Tab. 9 ubi supra.

inflected, and furnished with *exterior laciniæ* palpigerous just below their apex (*k*), but the intermediate *lacinia* is neither flat nor emarginate. In the two families of *Melitta*, included in this genus, though flat, it cannot be called elongate, or emarginate (*l*), and its lateral auricles (*m*), are neither palpigerous nor corneous, but consist of a thin membrane. With respect to the term compressed, understood according to the definition of Fabricius, it will apply to neither of these *linguæ*. That of *Apis* being cylindrical, and that of *Melitta* depressed or flat.

How are we to account for insects differing so widely in their *Intrumenta cibaria* being put into the same genus? The truth appears to be, that instead of taking the trouble of examining these organs in individuals, Fabricius referred all species to this genus, whose body was narrow and cylindrical: this is evidently the reason why the males of one family of *Melitta*, though agreeing with the other sex in their *proboscis*, are separated from them and inserted here. Any *entomologist*, who was at all in the habit of studying the genus *Apis*, upon a slight comparison of *Hylæus truncorum*, *maxillosus*, &c. with *H. annulatus*, or *H. quadricinctus*, or *flavipes*, &c. without examining their oral instruments, would be convinced that they belonged to a different division. So that in the

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(*k*) Tab. 9. **. c. 2. γ. fig. 3. *b b. d d.* fig. 1. *c.* and Tab. 2. **. b. fig. 2.

(*l*) Tab. 1. *. b.

(*m*) Ibid. *a a.*

arrangement of them *primâ facie* appearance could have been the only guide which Fabricius consulted. That one, who makes every thing depend upon these parts, should pay no regard to them himself is scarcely tolerable. Had he inspected the *Apes* he has inserted into this genus, he would have discovered that they were distinguished from the rest not only by their *proboscis*, but also by their *lip*, (*Clypeus*, Fab.): since they form a subdivision of that family in which this part is inflected (*n*); in *Hylæus maxillosus* it is remarkably elongated (*o*).

ANDRENA. *Character Naturalis.*

Os maxillis, palpis, linguâque inflexâ trifidâ.

Palpi quatuor inæquales, filiformes.
  Anteriores porrecti, longiores, sexarticulati articulis cylindricis, æqualibus, adhærentes flexuræ maxillæ.
  Posteriores brevissimi, biarticulati articulis æqualibus, cylindricis, sub apice setarum labii inserti.

Mandibula recta, cornea, fornicata, inermis.

(*n*) Tab. 10. **. c. 2. δ. fig. 13. *c.*

(*o*) Tab. 9. **. c. 2. γ. fig. 2. *b.* In this figure the lip is represented in the situation it assumes when the proboscis is unfolded; when that organ is folded, the lip is inflected, and covers it.

Maxilla cornea, apice membranacea, compressa, inflexa, labio multò breviore, linguæ lacinias exteriores constituens.

Labium porrectum, cylindricum, basi corneum, apice membranaceum, inflexum, utrinque juxta flexuram setis duabus membranaceis, rectis, rigidis, exteriore longitudine dimidii labii, interiore brevissimâ, compressâ, incurvâ.

Antennæ breves, filiformes, subpetiolatæ; articulo primo paulò longiori, secundo basi attenuato, reliquis æqualibus, brevibus.

Larva apoda, mollis, antice gibba, obtusa, postice attenuata.

Puppa quiescens imagini simillima.

Victus et larvæ et imaginis e nectare florum.

Character Artificialis.

Os linguâ trifidâ.

Labium cylindricum maxillâ longius, utrinque setis duabus membranaceis.

Antennæ filiformes.

Under this genus Fabricius has likewise arranged insects that differ greatly from each other in their *Instrumenta cibaria.* Thus *Andrena bicolor, pilipes, labiata, helvola,* and *hæmorrhoidalis,* are *Me-*

littæ of one family; *A. succinta* belongs to another; while *A. cærulescens*, *ænea*, and *bidentata*, are genuine *Apes*. Of these, *Andrena bicolor* is nothing more than the male of *Apis thoracica*, and has precisely the same oral organs (*p*); and *Andrena labiata* is the male of *Nomada cingulata*. The *exterior palpi* are sexarticulate in all the *Melittæ* (*q*), but in *Andrena ænea* and *cærulescens* they consist of four articulations (*r*), and in *A. bidentata*, which, if I am not mistaken, comes into the same subdivision with *Apis centuncularis* (*s*), they are most probably biarticulate (*t*). The *interior palpi* in all the *Apes* here quoted have two joints only, and emerge just below the apex of the *exterior laciniæ* (*u*), which are here denominated *setæ*, but in all the *Melittæ* above-mentioned, these *palpi* are quadriarticulate, as I observed above, and arise from the tongue just above the tube. The *mandibulæ*, in this genus, can be called "*rectæ*" only in the *Apes*, in the *Melittæ* they are usually *incurvæ*. In the latter, in one sex, they are often, but not always, *endentulæ* (*x*); but in the former, their apex is furnished with teeth in both (*y*). His characters, with respect to the *maxillæ* or *valvulæ*, will apply

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(*p*) Tab. 3. **. c. fig. 3—6.

(*q*) Ibid. **. b. fig. 2. *a*. and c. fig. 6. *a*.

(*r*) Tab. 10. **. c. 2. δ. fig. 3. *a*.

(*s*) Tab. 8. **. c. 2. α.

(*t*) Ibid. fig. 3. *c*.

(*u*) Ibid. fig. 2. *ff*. and Tab. 10. **. c. 2. δ. fig. 2. *aa*.

(*x*) Tab. 4. **. c. fig. 3—8.

(*y*) Tab. 8. **. c. 2. α. fig. 9—16. and Tab. 10. **. c. 2. δ. fig. 9—11.

better to the *Apes* that he has included in this genus, than to the *Melittæ*, the summit of whose *valvulæ*, which are not much shorter than the tongue, is coriaceous. In the *Apes*, these have sometimes a membranaceous margin. The definition of the *labium* will apply only to *Apis*.

APIS. *Character Naturalis.*

Os maxillis, palpis, linguâque inflexâ quinquefidâ.

Palpi quatuor brevissimi, inæquales, filiformes.

Anteriores paulò longiores, sexarticulati, articulis æqualibus, flexuræ maxillæ adhærentes.

Posteriores quinquearticulati articulis æqualibus, sub apice laciniarum exteriorum labii inserti.

Mandibula porrecta, cornea, recta, obtusa, dentata.

Maxilla porrecta, cornea, basi cylindrica, cum labio connata, apice compressa, acuta, integra marginibus membranaceis, in medio inflexa, laciniam linguæ exteriorem constituens.

Labium porrectum, corneum, basi cylindricum, apice trifidum, laciniis lateralibus dilatatis, membranaceis, sub apice palpigeris; intermediâ longiori, retractili, tereti, pilosâ, lacinias interiores linguæ constituens.

Antennæ filiformes, breves, articulo primo longissimo, incurvo, reliquis brevibus, æqualibus.

Larva apoda, mollis, gregaria intra cellulas hexangulares.

Puppa, quiescens, imagini simillima.

Victus, et larvæ et imaginis, e nectare florum, melle, fructibus dulcibus.

Character Artificialis.

Os linguâ inflexâ, quinquefidâ.

Palpi brevissimi.

Antennæ filiformes.

In his preface to his *Genera Insectorum* Fabricius has this observation, "*Auctorum descriptiones, figuras, nunquam ad generum determinationem adhibere valui. Omnes oris partes planè omiserunt.*" This is an assertion much too large and unqualified; and had he consulted the descriptions and figures, which Swammerdam and Reaumur have given of the *Instrumenta cibaria* in this genus, and which De Geer, (whose work is a rich mine from which much important information may be drawn relative to every part of the history of insects) has given in others; it would, perhaps, have prevented him from running into so many egregious errors. Nay, had he only examined the *proboscis* of the hive bee, or any common *Bombinatrix*, he must have discovered the inaccuracy of the characters here given. But to come to particulars: this genus, like the preceding, is a "*rudis indigestaque moles*" of *Melittæ* and *Apes,* taken from all families, each distinguished from the others by peculiarities in its *Instrumenta cibaria.* Thus, *Apis seladonia* belongs to one family of *Melitta*; *Apis cunicularia, thoracica, cineraria,* and *vestita* to another: the *exterior palpi* of all these consist of six articulations, and by no means agree with the term "*brevissimi* (z)," and the *interior palpi* of four. *Apis latipes, violacea, æstuans, pilipes, rotundata,* &c. belong to a family of *Apes,* whose *exterior palpi,* like those of the preceding, are sexarticulate (*a*); but their *interior* are only biarticulate (*b*). *Apis mellifica* and all the true *Bombinatrices, A. terrestris, hortorum,* &c. have their *exterior palpi* extremely short; but, instead of six, they consist only of a single joint (*c*). The same remark extends to *A. manicata* (*d*), which belongs to a subdivision of that family remarkable for its inflected lip. *Apis bicornis, tunensis, rufa,* &c. enter into another of its subdivisions, the same which includes *Andrena cærulescens* and *ænea,* distinguished, as above observed, by *exterior palpi* of four articulations. *Apis conica, quadridentata,* and *centuncularis* appertain to two other branches of the same family, whose *exterior palpi* are biarticulate (*e*); and *Apis punctata, luctuosa,* &c. are of another family, related to the *Nomadæ*, with *exterior palpi* of five articulations (*f*). The same objections attach to the characters of the *mandibulæ* as in the former genera. The *maxilla* or *valvula* is not connate with the *labium* or tongue in any species that I have examined, it may sometimes be attached to its base, or the upper side of the tube by membrane: in that family which includes *Apis violacea*, &c, or what I call the *false Bombinatrices*, its apex, instead of having a membranaceous margin, is entirely corneous.

(z) Tab. 3. **. c. fig. 6 *a*.

(*a*) Tab. 11. **. d. 2. α. fig. 2.

(*b*) Ibid. fig. 1. *i i*.

(*c*) Tab. 12. **. e. 1. neut. fig. 6. *d*. Tab. 13. fig. 3. *b*. and fig. 4, 5, 6.

(*d*) Tab. 9. **. c. 2. β. fig. 2. *d d*. and fig. 4.

EUCERA. *Character Naturalis.*

Os palpis, maxillis, linguâque inflexâ, septemfidâ.

Palpi quatuor, inæquales, filiformes.

Anteriores quinquearticulati, articulo secundo longiori, crassiori, reliquis æqualibus, adhærentes flexuræ interiori maxillæ.

Posteriores breviores, quadriarticulati, articulis æqualibus, adnati laciniis exterioribus labii.

Mandibula cornea, incurva, acuta, edentula.

Maxilla elongata, cornea, compressa, in

(*e*) Tab. 7. **. c. 1. *α*. fig. 3. *a*. Tab. 8. **. c. 2. *α*. fig. 3. e.

(*f*) Tab. 6. **. a. fig. 1. *g*.

term should be *exterioribus* (*k*). At first, Fabricius included only such male insects in this genus, as had antennæ nearly as long as the body, but in his supplement he has inserted two species of the other sex.

NOMADA. *Character Naturalis.*

Os maxillis, palpis, linguâque inflexâ, trifidâ.

Palpi quatuor, inæquales, porrecti, filiformes.

Anteriores breviores, sexarticulati, articulis æqualibus, cylindricis, adhærentes flexuræ maxillæ.

Posteriores quadriarticulati, articulis cylindricis secundo longissimo, linguæformi; labii medio inserti.

Mandibula cornea, fornicata, acuta, integra.

Maxilla basi cornea, cylindrica, apice porrecta, compressa, membranacea, acuta, integra, linguæ exteriorem laciniam constituens.

Labium cylindricum, elongatum, basi corneum, apice membranaceum, acutum, compressum, integrum, linguæ laciniam interiorem constituens.

Antennæ filiformes, breves, articulo primo paulò longiori, reliquis æqualibus, brevibus, rotundatis.

(*k*) Tab. 10. ubi supra, fig. 2. *a a.*

Character Artificialis.

Os linguâ inflexâ trifidâ.

Palpi quatuor inæquales; postici linguæformes articulo secundo longissimo.

Antennæ filiformes.

In this genus, of which Fabricius has described only fifteen species, are included insects which belong to the third and fifth families of my genus *Melitta*, and to the second and fourth of *Apis*, all differing as to their *Instrumenta cibaria*, Besides these, others belong to a family of which we have no species in England; whose *proboscis* I have not had an opportunity of examining (*l*); and *Nomada punctata* is either a variety of *Vespa uniglumis*, Lin. or nearly related to it. His description agrees exactly with my specimens of that insect, which is well figured by Panzer (*m*), only the four posterior tibiæ are coloured black, instead of dusky ferruginous. Thus *Nomada gibba* belongs to the third family of *Melitta*, *N. cingulata* to the fifth (*n*); *N. ruficornis, rufipes, striata, Fabriciana,* and *fulvicornis* to my second family of *Apis*; *N. variegata* to my fourth. *N. Histrio* and *scutellaris* seem connected with *Apis punctata*, but in these the "*Scutellum porrectum et emarginatum*," indicates

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(*l*) Viz. *N. histrio, scutellaris,* &c. (*m*) Fn. Ins. Germ. Init. N° 64. t. 14. *Crabro uniglumis.* (*n*) I observed above that *Andrena labiata* is the male of this.

that they ought to form a separate subdivision. *N. punctata* was accounted by Linneus a *Vespa*, but its tongue subemarginate, *antennæ anteriores*, and silver *nasus* give it a nearer affinity to those *Spheces*, which Fabricius has arranged under his genus *Crabro*. In the two families of *Melitta*, above alluded to, the *proboscis*, the *interior palpi* and *auricles* being excluded, is trifid (*o*), but not inflected; in *N. ruficornis*, &c. it is inflected and at first appears trifid, but if closely examined under a good magnifier, it will be found, exclusive of the *interior palpi*, to be quinquefid (*p*). *N. variegata* is furnished both with *interior* and *exterior laciniæ*, consequently in that the tongue is septemfid (*q*). With respect to the *palpi* they are sexarticulate in *Melitta*, and I believe so in *Nomada ruficornis*, &c. (*r*), but in *N. variegata* they consist of only a single joint (*s*). The *interior palpi* are quadriarticulate in *Melitta* and *N. ruficornis*, &c. (*t*), but in *N. variegata* they have two joints (*u*). With respect to the second joint of these *palpi*, in the form of which Fabricius makes the essence of the genus to consist, it is neither elongate nor linguæform in any of these families of either genus, the species of which I have had an opportunity of

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(*o*) Tab. 2. **. a. fig. 1. Tab. 3. **. c. fig. 3. (*p*) Tab. 5. *. b. fig. 2, 3. (*q*) Tab. 6. **. b. fig. 2, 3. (*r*) Tab. 5. *. b. fig. 4. *d*. (*s*) Tab. 6. **. b. fig. 4. *d*. (*t*) Tab. 5. *. b. fig. 3. *b*. (*u*) Tab. 6. **. b. fig. 3. *b*.

examining (x). What it may be in the family to which *N. scutellaris* belongs I am not able to say. The *Mandibulæ* are entire only in the two families of *Apis*. In *N. gibba* they are deeply bifid at the apex in one sex (y). The terms "*cylindricum et elongatum*" will apply only to the *labium* of the genuine *Apes*.

From this review of what Fabricius has done in this genus, one is almost led to suppose that he formed his *Natural Characters*, "*undique collatis membris*," and took one member from the *proboscis* of an insect of one family, a second from that of another, and so on. If this be the case it is a vain attempt to conjecture from what individuals such jarring definitions were derived.

> ——— cujus, velut ægri somnia, vanæ
> Fingentur species: ut nec pes nec caput uni
> Reddatur formæ. ———

It must now, I think, be evident to every unprejudiced examiner, that this author has committed perpetual and unaccountable mistakes in the genus in question. That, in the arrangement of species, instead of abiding by his own characters, in a class of insects in which the *Instrumenta cibaria* are very easy to be examined, he has been led solely by habit, or rather *primâ facie* appearance:

(x) Tab. 2. **. a. fig. 1. *gg*. Tab. 3. **. c. fig. 5. *cc*. Tab. 5. *. b. fig. 3. *b*. Tab. 6. **. b. fig. 3. *b*. (y) Tab. 2. **. a. fig. 6.

that he has done the utmost violence to nature, mixing distinct genera and families, and separating those that are most nearly related, even the sexes, placing the males in one genus and the females in another, though both have the same oral instruments (z), and instead of order and true system, introducing the greatest confusion and disorder.

A system so constructed, which is the cause of so much confusion and distortion of nature, can never be lasting; the more closely it is examined, the more deficient will it be found, and probably it will not long survive its author. While that of Linneus, which Fabricius and his followers have treated with such undeserved contempt, receiving daily those improvements of which it is capable and which it demands, will descend, because founded on the sure basis of truth and nature, to the latest posterity, and, in conjunction with his other glorious labours, immortalize his name to all generations.

Gmelin has done little more than combine Linneus with Fabricius, adopting for families, the then new genera of the latter; I shall therefore altogether pass over his character of this genus.

(z) The mistake of sexual characters for those of genera or families, is so natural in those who do not examine insects, in this genus, anatomically, that it is not to be wondered at, and may be allowed for. But the case is much altered, when such mistakes are made by one, whose whole system is built upon those parts in which the sexes do agree.

ADDITIONAL REMARKS.

AFTER the greatest part of the preceding remarks were printed, I met with two authors of whose labours in this class and genus it will be proper to take some notice. I mean Roemer and Latreille.

In the year 1789, Roemer published a very elegant work, entitled, "*Genera insectorum Linnæi et Fabricii iconibus illustrata.*" In this work he gives the following character of the class *Hymenoptera*, which adds several circumstances to that laid down by Linneus.

HYMENOPTERA. *Alæ* quatuor, membranaceæ, nudæ, nervis pro alarum magnitudine fortioribus interstinctæ.
Os maxillis duabus validis.
Stemmata tria.
Cauda aculeo armata in feminis.

This character is very accurate, except the first member of it, which will not hold good universally, since many *Hymenopterous* insects are distinguished by wings without veins: its application, therefore, ought to have been restricted by the term *sæpius* or *plerisque*, as a general, but not invariably constant character. In his genera he has destroyed the simplicity of the Linnean definitions, by the insertion of a variety of additional characters. Some of these are common to the class; for instance, the *stemmata*, and number of articulations of the *tarsi*. Others are hastily adopted without sufficient examination, as where he assigns only two palpi to *Cynips* and several other genera, which in fact have four; and in his character of *Tenthredo*, in which, instead of naming six as the number of joints of the exterior palpi, and four of the interior, he attributes to the former, four only, and to the latter, two. Again, others of his additional characters are not universal, as when he says, under *Tenthredo*, "*Labio superiore constanter cum pedibus concolore.*" In several species of that genus this does not hold good (*a*). The character of *Vespa* he has much improved by introducing the tongue. I shall copy his definition of *Apis*.

APIS. *Os* maxillis dentatis, atque *proboscide* inflexâ, vaginis duabus bivalvibus *linguam* includentibus.
Caput triangulare, fronte planâ, flexum.
Antennæ sæpe pedatæ, primo articulo reliquis longiore.
Alæ planæ, in omni sexu.
Aculeus punctorius reconditus, retractilis, serratus, feminis et neutris.

(*a*) E. G. In *Tenthredo Vitellinæ, sericea, nitens,* Lin. *bicolor,* Enum. &c.

Tarsi quinque articulis, primo longitudine tibiæ, compresso, ciliato, transversim sulcato.

The greater part of the additional circumstances introduced into this character, belong only to certain families, and are not common to the whole genus; and the last, viz. the transversely sulcated first joint or *planta* of the *tarsus*, is peculiar to the neuter of *Apis mellifica*.

The other work which I mentioned, was published at Paris about six years since by M. Latreille, under the title of "*Précis des caractères génériques des insectes, disposés dans un ordre naturel.*" This is a work of considerable merit, in which the author manifests no common degree of industry and accuracy, aided by great abilities. Though a professed admirer of Fabricius, he proves himself to be

> Nullius addictus jurare in verba magistri.

and with great good sense rejects the Fabrician nomenclature of the classes, retaining, for the most part, that of Linneus. The *Hymenopterous* insects constitute his fifth class, which he thus defines:

HYMÉNOPTÈRES. *Hymenoptera.*	Quatre ailes inégales, nues, veinées, inférieures plus petites. Bouche munie de mandibules. Une langue ou lèvre inférieure renfermée

mée à sa base dans une
gaîne coriace qui s'emboîte
sur les côtés, dans
les mâchoires.

This character agrees very well with the insects of this class, with the exception of *ailes veinées*, which, as I just now observed, are not common to the whole: but still I prefer that of Linneus, on account of its including the *aculeus*, its most remarkable and striking distinction.

Instead of subdividing his genera, this author divides the class into sections and families, the characters of which are drawn from the *antennæ*, *os*, *labium inferius*, *lingua*, *maxillæ*, Fab. *tubus*, and *palpi*. He gives forty-three *Hymenopterous* genera, without including those of Fabricius's supplement: the characters of these are taken from the *antennæ*, *labium superius*, *mandibulæ*, *lingua*, *maxillæ*, Fab. *tubus*, and *palpi*. There cannot be a stronger proof that differences in the *antennæ* and *instrumenta cibaria* are not the best foundation for characteristics of genus in this class, than the great and unnecessary multiplication of genera by those who build their system upon them. Characters of families are mistaken for distinctive marks of a genus; and thus natural genera are taken to pieces, and, if this practice continues, we shall have no such thing as a subdivision in any. The different families of the Linnean genus *Tenthredo*, are all characterized from variations in

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the antennæ; according to this principle, they ought to constitute so many different genera; and if it be applied to *Apis*, instead of five genera into which Fabricius has divided it, it should be frittered into eighteen, from differences observable in the *instrumenta cibaria* of its numerous families. But to proceed with our author. The genera he has given are arranged in the following order.

1. *Urocerus*, after Geoffroy, taken from *Sirex*, Lin. 2. *Sirex*, taken from *Sirex* and *Tenthredo*, Lin. 3. *Tenthredo*, Lin. 4. *Cimbex*, Olivier. This is the *Crabro* of Geoffroy, and consists of those insects which constitute Linneus's first family of *Tenthredo*. 5. *Proctotrupes*, Latr. If I am not mistaken in the insects which M. Latreille intends by this genus, it is a distinct one: I have always been at a loss where to refer the species that belong to it. I do not know that any other author has noticed any of them. 6. *Cynips*, after Geoffroy, this genus takes in no genuine *Cynips*, but includes a large proportion of the *Ichneumones Minuti* of Linneus, the *Eulophus* of Geoffroy, and *Chalcis* of Fabricius. It would be a good genus without *Chalcis*, but it should have another name, as *Cynips* ought to be continued to the gall nut insects. 7. *Leucospis*, Fab. 8. *Diplolepis*, Geoff. *Cynips*, Lin. 9. *Diapria*, Latr. taken from the *Ichneumones Minuti*, Lin. 10. *Orussus*, Latr. *Sphex*, Scop. An *Oryssus*, Fab.? 11. *Ichneumon*, Lin. 12. *Gasteruption*, Latr. *Ichneumon*, Lin.

This genus appears to me to be the same with *Foenus* of the supplement of Fabricius. 13. *Evania*, Fab. 14. *Astata*, Latr. 15. *Sphex*, Lin. This includes my genus *Ammophila* only. 16. *Psammochares*, Latr. taken from *Sphex*, Lin. This is probably the same with *Pompilus*, Fab. 17. *Larra*, Fab. 18. *Tiphia*, Fab. 19. *Myrmosa*, Latr. 20. *Mutilla*, Lin. 21. *Dorylus*, Fab. 22. *Formica*, Lin. 23. *Trypoxylon*, Latr. from *Sphex*, Lin. 24. *Psen*, Latr. from *Sphex*, Fab. 25. *Ceropales*, Latr. taken from *Evania*, *Vespa*, and *Crabro*, Fab. 26. *Mellinus*, Fab. 27. *Nysso*, Latr. from *Crabro*, Fab. 28. *Chrysis*, Lin. 29. *Parnopes*, Latr. from *Chrysis*, Fab. 30. *Pemphredon*, Latr. from *Crabro*, Oliv. 31. *Oxybelus*, Latr. from *Vespa*, Lin. and *Crabro*, Fab. 32. *Crabro*, Fab. 33. *Bembex*, Fab. 34. *Masaris*, Fab. 35. *Vespa*, Lin, 36. *Philanthus*, Fab. 37. *Sapyga*, Latr. from *Scolia*, Fab. 38. *Scolia*, Fab. 39. *Hylæus*, Fab. 40. *Andrena*, Fab. 41. *Nomada*, Fab. 42. *Apis*, Lin. 43. *Eucera*, Scop. and Fab.

The genera into which our author, after Fabricius, has divided *Apis* are arranged under his tenth and eleventh families. The characters of the first of these families belong to those insects which I have considered as constituting one genus under the name *Melitta*, those of the other as peculiar to genuine *Apes*. They are both drawn up, with very great accuracy, in the following terms.

7. Fam. 10. Mâchoires et langue très-alongées, deux ou trois fois plus longues que la tête, dirigées en avant dans l'inaction, et dont la base ressort inférieurement de la cavité ou elles sont logées. Partie saillant de la langue évasée, a trois divisions, plus courte que la gaîne: celle-ci longue, cylindrique. Antennules courtes, filiformes, de six et quatre articles.

The *tubus,* here called, *la gaîne,* in this division is often conical, and the *palpi* are setaceous rather than filiform. Here are arranged the two Fabrician genera *Hylæus* and *Andrena,* with these characters:

HYLÆUS. Antennes insérées au milieu du front, courtes, grosses; premier article alongé, les autres formant presque une masse cylindrique, divergente; filiformes dans d'autres. Langue large; division du milieu échancrée, dentelée, ciliée.

This character was probably taken from *Apis annulata,* Lin., to which it applies very well, as does also his *Caractère Habituel* of this genus; but the intermediate piece of the tongue is truncate, rather than emarginate (*b*). He would of course exclude from it *A. maxillosa, truncorum,* &c. which belong to his next family, and I should suppose also *Hylæus*

(*b*) Tab. 1. *. b. fig. 1. *c.*

læus albipes and its affinities, the tongue of these being that of his genus *Andrena*.

ANDRENA. Antennes filiformes. Langue oblongue; division du milieu en point refendue.

This genus would include all my families of *Melitta* but the first and second. The character is extremely accurate, but the point of the intermediate division of the tongue is lacerate rather than cleft (*c*).

8. Fam. 11. Langue très-prolongée, étroite, linéaire, presque cylindrique, un peu coriacée, à papilles vers l'extrémité, fléchie à la sortie de la gaîne. Mâchoires fléchies. Antennules antérieurs très-courtes, presque obsolètes, sétacées.

That part of this character which regards the exterior palpi is not accurate, for in the true *Nomadæ*, the *Euceræ*, and two other of my families of genuine *Apes*, these are as long as in the *Melittæ* of the preceding family, and consist of six joints (*d*). He probably took his idea of them from *Apis mellifica*, or the *Bombinatrices*. Here are arranged the remaining genera which Fabricius separated from *Apis*: viz. *Nomada*, *Apis*, and *Eucera*.

(*c*) Tab. 2. **. a. fig. 1. and b. fig. 1, 2.

(*d*) Tab. 5. *. b. fig. 4. *d*. Tab. 10. **. d. 1. fig. 1. *d*. Tab. 11. ** d. 2. α. fig. 2. 9.

NOMADA. Langue d'une pièce, avec deux très-
petites soies latérales.

This character is accurate, but it would also take in my first family of *Apis* (*e*).

APIS. Langue de trois pièces. (Organes de la
nutrition plus petits dans les mâles).

In this character the interior laciniæ are overlooked. The *Caractère Habituel* of this genus seems to have been drawn from *A. mellifica*, for it thus describes the eyes: "*Yeux entiers alongées, occupant tout le front dans les mâles*;" a circumstance which is peculiar to that sex of that species. And of the neuter it says, "*Premier article des tarses très-grands, strié transversalement dans les mulets.*" which is the peculiarity of the working hive bee.

EUCERA. Langue de cinq pièces. Antennes
souvent plus longues que le corps.

This character is accurate as far as it goes. The long *antennæ*, as before observed, are a sexual distinction.

I cannot conclude these remarks without inserting a passage which I lately met with in Ray's Letters, from which it will appear that that skilful entomologist Dr. Martin Lister had a distinct idea of the *Hymenoptera* class. "I cannot, methinks," says he, in a letter addressed to Ray, "exclude these hairtailed insects from the family or genus of

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(*e*) Tab. 4. *. a. fig. 4. *a a*. Tab. 5. *. b. fig. 3.

of wasps, although all of them, that I know, are neither favificous nor gregarious, nor have artificial meat stored up for them; yet have they the shape and parts of wasps exactly, as well in the worm and chrysalis, as when they are in perfection: besides, *I have observed a peculiar note belonging to the bee kind which is not wanting in these; and that is, three balls in a triangle, in the forehead of them all, which nobody hitherto, that I know of, has taken notice of.* But I much like the making of genus's and tribes *ex moribus et vitâ*; though I would not as near as may be have the form excluded (*f*)."

(*f*) p. 81.

MONOGRAPHIA
APUM ANGLIÆ.

PARS PRIMA

TABULAM SYNOPTICAM NOMENCLATURÆ PARTIUM,
ATQUE
TERMINUM EXPLICATIONEM SISTENS.

Quam multiplicata sunt opera tua, JEHOVA! Omnia ipsa in SAPIENTIA fecisti: impleta est terra possessionibus tuis.
Ps. civ. 24.

In his tam parvis, atque tam nullis, quæ ratio! Quanta vis! Quam inextricabilis perfectio! Plin.

Admiranda tibi levium spectacula rerum. Virg.

Vol. I.

TABULA SYNOPTICA NOMENCLATURÆ PARTIUM

- CORPUS.
  - CAPUT.
    - *Occiput*
    - *Facies*
      - Vertex — *Stemmata*
      - Oculi
      - Frons
      - Nasus
    - *Genæ*
    - *Labium*
    - *Maxilla*
    - *Gula*
    - *Jugulum*
    - *Antennæ*
      - Radicula
      - Scapus
      - Pedicellus
      - Apex
    - *Proboscis*
      - Lingua
        - *Basis*
        - *Apex*
      - Vagina
        - *Tubus*
          - Fulcrum
          - Auriculæ
          - Laciniæ
            - *Exteriores*
            - *Interiores*
        - *Valvula*
          - Basis
            - *Cardo*
            - *Pecten*
          - Apex
        - *Palpi*
          - Exteriores
          - Interiores
        - *Lora*
        - *Annulus*
  - TRUNCUS.
    - *Collum* — Collare
    - *Thorax* — Tubercula
    - *Scutellum*
    - *Metathorax*
    - *Pleura*
    - *Pectus* — Sternum
    - *Alæ*
      - Superiores
        - *Squamula*
        - *Anastomosis*
        - *Costa*
        - *Nervi*
      - Inferiores — *Hamuli*
    - *Pedes*
      - Apophysis — *Flocculus*
      - Femur
      - Tibia
        - *Spinula*
        - *Scopa*
        - *Corbicula*
      - Manus — *Palma* — Strigilis
      - Tarsus
        - *Planta* — Scopula
        - *Digitus*
          - Unguis
          - Pulvillus
  - ABDOMEN.
    - *Tergum*
      - Segmenta dorsalia — *Spiracula*
      - Petiolus
      - Basis
      - Anus
        - *Fimbria*
        - *Aculeus*
          - Valvæ
          - Vagina — *Spicula* — Retinaculum
        - *Penis*
          - Forceps
          - Phallus
    - *Venter* — Segmenta ventralia.

TERMINUM EXPLICATIO.

CORPUS dico, ubi animal totum, simul sumptum, intelligi volo: hoc in tres partes primarias distribuo; CAPUT, nempe, TRUNCUM, ABDOMEN.

I. CAPUT.

Pars antica corporis *occiput*, *faciem*, *genas*, *gulam*, et *jugulum* includens. Organa ejus mobilia sunt *labium*, *maxillæ*, *antennæ*, atque *proboscis*.

1. *Occiput*. Capitis pars postica collari applicans(*a*).
2. *Facies*. Capitis pagina superior *verticem*, *stemmata*, *oculos*, *frontem*, et *nasum* includens.

a. *Vertex*. Portio faciei inter occiput et oculos (*b*).
b. *Stemmata*. Puncta tria, convexa, chrystallina, ocelli forsan, quæ verticem signant (*c*).
c. *Oculi*. Visûs organa ex innumeris hexagonis constantia.
d. *Frons*. Spatium interjectum inter oculos infra verticem unde proveniunt antennæ, quod in angulum acutum inter nasum et oculos sæpe excurrit (*d*).

(*a*) Tab. 12. **. e. 1. neut. fig. 8. *d*. (*b*) Ibid. *a*.
(*c*) Ibid. (*d*) Ibid. *b*.

e. *Nasus*.

c. *Nasus.* Faciei portio sæpius elevata *f.* gibba infra antennas, cui labium annectitur; a fronte suturâ haud rarò separata (*e*).

3. *Genæ.* Capitis latera turgida sub oculis (*f*).

4. *Labium.* Pars transversa capitis, posticè naso subnexa, os supernè claudens, et proboscidem cohibens (*g*).

5. *Maxillæ,* Dentes transversi insecti os a latere includentes, apud basin sæpius puncto elevato notati (*h*).

6. *Gula.* Inferioris paginæ capitis cavitas antica, fundo sæpius membranaceo, ubi proboscis plicata reponitur (*i*).

7. *Jugulum.* Capitis cavitas postica quà collo annectitur (*k*).

8. *Antennæ.* Cerebelli forsan speculatores sensiferi, articulati, *radiculâ, scapo, pedicello,* et *apice* constantes.

a. *Radicula.* Articulus primus minutissimus, capiti immersus (*l*).

b. *Scapus.* Articulus secundus sæpius elongatus, quocum angulum sæpe facit apex (*m*).

c. *Pedicellus.* Articulus tertius, in acetabulo scapi versatilis (*n*).

d. *Apex.* Reliqui articuli simul sumpti (*o*).

(*e*) Tab. 12. **. e 1. neut. fig. 8. *c.* (*f*) Ibid. fig. 9. *aa.* (*g*) Ibid. fig. 8. *e.* (*h*) Ibid. *f.* (*i*) Ibid. fig. 9. *c.* (*k*) Ibid. *b.* (*l*) Ibid. fig. 13. *a.* (*m*) Ibid. *b.* (*n*) Ibid. *c.* (*o*) Ibid. *d.*

9. *Proboscis.* Organum capitis os infernè claudens, *linguâ* centrali, et *vaginâ*, interdum multivalvi, constans (*p*).

a. *Lingua.* Suctionis instrumentum cartilagineum in *apicem* et *basin* distinctum (*q*).

α. *Apex.* Linguæ portio extra tubum (*r*).

β. *Basis.* Linguæ portio intra tubum (*s*).

b. *Vagina.* Liguam ex omni parte convolvens, muniens, ac fovens, *tubo, valvulis, palpis, loris,* et *annulo* constans (*t*).

α. *Tubus.* Theca cornea basis linguæ *fulcrum, auriculas, laciniasque* includens (*u*).

a. Fulcrum. Portio cornea cui insidet tubus (*x*).

b. Auriculæ. Valvæ duæ membranaceæ, *Melittis* propriæ, linguam apud apicem tubi munientes (*y*).

c. Laciniæ. Sæpius quatuor, est ubi duæ, *Apibus* propriæ, linguam apud apicem tubi vaginantes, in *exteriores* et *interiores* distinctæ.

*. *Laciniæ exteriores.* Valvæ duæ, planiusculæ vel concavæ, biarticulatæ, paulò infra apicem palpigeræ, linguæ apicem subtus munientes (z).

**. *Laciniæ interiores.* Valvæ duæ sæpius membranaceæ, quæ intra lacinias exteriores linguam amplectuntur (*a*).

(*p*) Tab. 12. **. c. 1. neut. fig. 1. (*q*) Ibid. *f. i.* (*r*) Ibid. *i.* (*s*) Ibid. *f.* (*t*) Ibid. *a, b, c, d, e, f, g, h.* (*u*) Ibid. *f.* Tab. 1. *. b. fig. 1. *a.* (*x*) Tab. 12. ubi supra, *e.* (*y*) Tab. 2. **. a fig. 1. *d d.* b. fig. 2. *a a.* (*z*) Tab. 12. ubi supra, *g g.* (*a*) Ibid. *h h.*

β. *Valvulæ.* Laminæ *f.* valvæ duæ apud basin tubi originem ducentes, et palpum e sinu laterali emittentes, in *basin* et *apicem* divisæ (*b*).

a. *Basis.* Valvulæ pars cornea infra palpum, linguæ basin utrinque obvolvens, *cardinem* et *pectinem* includens (*c*).

*. *Cardo.* Portio cornea transversa inter basin valvulæ et lora interjecta (*d*).

**. *Pecten.* Setæ rigidiusculæ, incurvæ, quæ basis valvulæ apicem margine exteriori armant (*e*).

b. *Apex.* Valvulæ pars supra palpum, sæpe coriacea marginibus membranaceis, concava aut plicata, quæ linguæ apicem exteriùs convolvit, et, repositâ proboscide, apud sinum palpigerum inflectitur (*f*).

γ. *Palpi.* Organa sæpius articulata, mobilia, sensifera, e vagina exorta, in *palpos exteriores* et *interiores* distincta.

a. *Palpi exteriores.* 1—6 articulati e sinu laterali valvularum erumpentes (*g*).

b. *Palpi interiores.* 1—4 articulati ex linguâ paulò supra apicem tubi, vel ex laciniis exterioribus sub apice provenientes (*h*).

δ. *Lora.* Funiculi cornei membranâ connexi, qui-

(*b*) Tab. 12. ubi supra, *a, b.* and fig. 6.

(*c*) Ibid. fig. 6. *a.*

(*d*) Tab. 13. fig. 7. *cc.*

(*e*) Tab. 12. ubi supra, fig. 6. *c.* Tab. 10. **. d. 1. fig. 1. *c.*

(*f*) Tab. 12. ubi sup. fig. 6. *b.*

(*g*) Ibid. fig. 5. Tab. 8. fig. 3. *c.* Tab. 10. **. c. 2. δ. fig. 3. *a.* Tab. 6. **. a. fig. 1. *g.* Tab. 1. *. a. fig. 4. *d.*

(*h*) Tab. 9. **. c. 2. γ. fig. 5. *b.* Tab. 5. **. a. fig. 5. *dd.* Tab. 1. *. a. fig. 3. *bb.*

bus insidet proboscis, et quibus retinetur aut immittitur (*i*).

ε. *Annulus*. Gulæ ambitus quo terminantur lora (*k*).

II. TRUNCUS.

Intermedia pars corporis, *collum, thoracem, scutellem, metathoracem, pleuras, pectus* complectens. Artus ejus sunt *alæ* et *pedes*.

1. *Collum*. Pars trunci anterior, quà caput versatile est, *collarem* gestans (*l*).

a. *Collare*. Pars postica colli elevatiuscula, cui thorax annectitur (*m*).

2. *Thorax*. Dorsum trunci suturis undique designatus *tubercula* includens (*n*).

a. *Tubercula*. Puncta elevata duo, unum utrinque, sæpius apud angulos anticos thoracicos (*o*).

3. *Scutellum*. Trunci portio parva ponè thoracem, metathoraci sæpe immersa (*p*).

4. *Metathorax*. Pars trunci postica, cui inseritur scutellum, et subnectitur abdomen (*q*).

5. *Pleuræ*. Trunci latera turgida.

6. *Pectus*. Trunci pagina inferior cui inseruntur pedes, *sternum* complectens.

a. *Sternum*. Carina pectoris *f*. processus corneus pectori immersus, inter basin pedum anticorum delitescens vix agnoscendus (*r*).

(*i*) Tab. 12. ubi supra, fig. 1. *dd*. (*k*) Tab. 13. fig. 7. *bb*. (*l*) Tab. 5. *. b. fig. 8. *a*. (*m*) Ibid. *b*. (*n*) Ibid. *e*. (*o*) Ibid. *cc*. (*p*) Ibid. *f*. (*q*) Ibid. *g*. (*r*) Tab. 6. **. a. fig. 8. a.

7. *Alæ.* Volatûs instrumenta, apud thoracis suturam lateralem trunco affixa, in *alas superiores* et *inferiores* distincta.

a. *Alæ superiores ſ.* anteriores includunt *squamulam*, *anastomosin*, *costam*, et *nervos.*

α. Squamula. Squama minutissima, cornea concavo-convexa, extrorsum rotundata, basin alarum superiorum muniens (*s*).

β. Anastomosis. Macula cornea marginalis, ubi inosculantur alæ superioris nervi (*t*).

γ. Costa. Nervus validus marginalis (*u*).

δ. Nervi. Alarum venæ.

b. *Alæ inferiores ſ.* posteriores *hamulos* includunt.

α. Hamuli. Unci minutissimi in medio margine alæ inferioris, quibus alæ superiori, volante insecto, subnectitur (*x*).

8. *Pedes.* Motûs instrumenta constant *apophysi*, *femore*, *tibiâ*, *manu*, *tarso.*

a. *Apophysis.* Coxa biarticulata cui insidet femur, *flocculum* includens (*y*),

α. Flocculus. Cincinnus parvus ex apophyse posteriori exortus, quo pollen florum a *Melittis* quibusdam gestatur (z).

b. *Femur.* Pedis basis apophysi insidens (*a*).

c. *Tibia.* Pedis pars intermedia *ſ.* crus, includens *spinulas*, *scopam*, et *corbiculam* (*b*).

(*s*) Tab. 5. *. b. fig. 8. *dd.* (*t*) Tab. 3. **. b. fig. 5. *b.* (*u*) Ibid. *a.* (*x*) Tab. 13. fig. 19. (*y*) Tab. 11. **. e. 1. mas. fig. 8. *a*, *b.* (*z*) Tab. 4. **. c. fig. 10. *a.* (*a*) Tab. 11. ubi supra, *c.* (*b*) Ibid. *d.*

α. Spinulæ.

ε. *Spinulæ.* Spinæ tenuissimæ, introrsum sæpius serrulatæ, tibiarum apicem intus armantes, *velum* complectentes (*c*).

α. *Velum.* Membrana tibiæ anterioris spinulæ intus annexa (*d*).

β. *Scopa.* Villi densi tibiam posticam sæpe vestientes, quibus pollen a floribus quasi verrunt, quod hisce villis involutum secum deportant (*e*).

γ. *Corbicula.* Pilorum incurvorum cilia, *Api mellificæ* et *Bombinatricibus* propria, tibiarum posticarum e margine utrinque exorta, per quam cera retinetur, nec inter volandum amittitur (*f*).

d. *Manus.* Pedis anterioris pars extima, articulata, *palmam* includens.

α. *Palma.* Manûs articulus primus elongatus, strigile instructus (*g*).

a. *Strigilis.* Curvatura parva intus apud basin palmæ pectine sæpius instructa, cui ex adverso opponitur tibiæ anterioris spinula velata. His, sicut strigile, antennas, ut opinor, detergunt insecta *Hymenoptera* (*h*).

e. *Tarsus.* Pedum quatuor posteriorum pars extima, articulata, *plantas* et *digitos* complectens (*i*).

(*c*) Tab. 13. fig. 20. *d*. (*d*) Tab. 6. **. a. fig. 7. *c*.
(*e*) Tab. 4. **. c. fig. 10. *b*. (*f*) Tab. 12. ubi supra, fig. 19. *b b*. (*g*) Tab. 6. ubi supra, fig. 7. *a*. (*h*) Ibid. *b*.
(*i*) Tab. 11. ubi supra, fig. 8. *e, f*.

α. *Planta.* Tarsi articulus primus elongatus, dilatatusque, *scopulâ* instructus (*k*).

a. *Scopula.* Scopa parva setarum rigidiuscularum, quæ plantas intus vestit, præcipuè posticas, in *Ape mellificâ* insignis (*l*).

β. *Digitus.* Tarsorum, item manûs, articuli ultimi quatuor, *ungues* et *pulvillum* includens (*m*).

a. *Unguis.* Ungula digitos terminans et armans, unguiculis constans duobus (*n*).

b. *Pulvillus.* Mollis digiti terminatio inter ungues (*o*).

III. ABDOMEN.

Pars corporis postica *tergum ventremque* complectens. Organa hujus mobilia sunt feminis *aculeus*, et *penis* maribus.

1. *Tergum.* Abdominis dorsum *s.* pars supina, *segmenta dorsalia, petiolum, basin,* et *anum* includens.

a. *Segmenta dorsalia.* Tergi sectiones transversæ, ventralium segmentorum latera obvolventes, *spiraculis* pertusæ.

α. *Spiracula.* Pori laterales, in singulo abdominis segmento dorsali utrinque solitarii, per quos respirat animal (*p*).

b. *Petiolus.* Pedicellus metathoraci basin abdominis subnectens,

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(*k*) Tab. 11. ubi supra, *e*. (*l*) Tab. 12. ubi supra, fig. 20. (*m*) Tab. 11. ubi supra, *f*. (*n*) Ibid. fig. 9. *aa*. (*o*) Ibid. *b*. (*p*) Tab. 13. fig. 35, 36. *a*.

c. *Basis.* Pars antica abdominis ex quâ oritur petiolus.

d. *Anus.* Abdominis apex genitalia exerens, *fimbriam*, *aculeum*, et *penem* complectens.

α. *Fimbria.* Pilorum cilia densa anum vestiens, *Melittarum* familiæ ultimæ propria (*q*).

β. *Aculeus.* Instrumentum ovipositionis, et in quibusdam bellorum gladius timendus, *valvas* et *vaginam* includens (*r*).

a. *Valvæ.* Laminæ duæ coriaceæ, quibus vagina retracta utrinque obtegitur (*s*).

b. *Vagina.* Theca cornea *spicula* jaculans (*t*).

*. *Spicula.* Aculei ipsissimi, intra vaginam retractiles, bini, filiformes, tenuissimi, apud apicem hinc retrorsum serrulati, *retinaculo* instructi (*u*).

†. *Retinaculum.* Squamula cornea, mobilis, quâ retinetur spiculum, ne justo longiùs jaculetur (*x*).

γ. *Penis.* Genitale maris *forcipem* et *phallum* complectens.

a. *Forceps.* Unci duo vel plures interdum internè ramosi, quibus mas corripit et comprimit anum feminæ (*y*).

b. *Phallus.* Organum masculum (*z*).

2. *Venter.* Prona pars abdominis *segmenta ventralia* includens.

h. *Segmenta ventralia.* Ventris sectiones transversæ.

(*q*) Tab. 4. **. c. fig. 1. *a.*

(*r*) Tab. 13. fig. 27, 28.

(*s*) Ibid. fig. 27. *b b.* 28. *a a.*

(*t*) Ibid. fig. 29.

(*u*) Ibid. fig. 28. *b b.* fig. 30.

(*x*) Ibid. fig. 30. *a.*

(*y*) Ibid. fig. 33. *a a.*

(*z*) Ibid. *b.*

OBSERVATIONS.

LINNEUS, in the *Fundamenta Entomologiæ*, has given *four* primary divisions of an insect; but since those parts, which he has included under his division *artus*, are all attached to the *truncus*, it seems most natural to consider them only as members of that part; so the *antennæ*, *maxillæ*, *labium*, and *proboscis* are included under the division *caput*; and the *genitalia* and *aculeus* under *abdomen*. I have therefore ventured, in this instance, to depart in some degree from the definitions of that admirable paper; and I do this with the less hesitation, since I have not been guided solely by my own judgment, but can plead the authority of Professor Afzelius, to whom I once shewed the outline of the above table, for this mode of division.

Facies. This term I have employed instead of *frons*, to denote the upper side of the head, using the latter in a more confined sense.

Nasus. The part intended by this word, has been noticed particularly by no author, that I have had an opportunity of consulting, except De Geer, who mistakes it, in *Formica*, for the lip (*a*), from which it is very distinct, and Latreille, who names it *le chaperon*. It is often separated from the *frons* by a suture, and in some

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(*a*) Tom. 2. p. 2. Mem. 18. p. 1056. Tab. 41. fig. 5. *l.*

genera, the genuine *Vespæ* especially (*b*), is very remarkable. Its situation is nearly that of the nose upon the human face, which circumstance induced me to give it this name.

Gula et Jugulum. These parts are both noticed by Reaumur (*c*). The bottom of the cavity of the former, he thinks, may be regarded as a kind of palate (*d*).

Radicula. The first joint of the antennæ, which I have denoted by this name, has been overlooked, in numbering the articulations of that part, by Linneus and most authors. De Geer has sometimes noticed, and at others omitted it (*e*); though it exists in all *Hymenopterous* insects. The accurate eye of Reaumur discovered it, at least in *A. mellifica* (*f*).

Scapus. I have applied this term to the second joint of the antennæ, which has been usually denominated "*antennarum articulus primus.*" Linneus occasionally distinguishes it by the name of *bulbus* (*g*). Reaumur calls it *le fuseau*, on account of its *fusiform* shape in *A. mellifica* (*h*).

(*b*) Panzer. Fn. Ins. Germ. Init. n. 17. t. 18. *a.* n. 63. t. 2. *a.*

(*c*) Tom. 5. Tab. 27. fig. 12. *o, c.*

(*d*) Ibid. p. 335.

(*e*) He has noticed it in *Formica*, &c. Tom. 2. p. 2. Tab. 41. fig. 8. *a.* Tab. 28. fig. 9. *a.* and omitted it in *Vespa*, &c. Tab. 27. fig. 5, 6.

(*f*) Ubi supra, Tab. 25. fig. 4. 13. *b.*

(*g*) E. G. In his description of *Scarabæus stercorarius*, Fn. Suec. 388.

(*h*) Ubi supra, p. 327, 328.

Pedicellus. This joint is the pivot, turning in the socket of the *scapus*, upon which the remaining articulations taken together, here denominated the *apex*, sit, and by means of which they often form an angle with that part. Reaumur terms it *le bouton* (*i*).

Proboscis. This term, as I observed before, I have used to signify the tongue and all the machinery that belongs to it and its vagina, in conformity to the practice of Linneus in *Apis*.

Lingua. De Geer sometimes calls this part "*le lévre inférieur* (*k*);" but certainly very improperly. It is possible that Fabricius might follow him in applying a similar term (*labium*) to the same part. In another place (*l*), by this term the same author denotes the whole *proboscis*, expressing a suspicion that the central part may perform the office of a tongue.

Vagina. This term is designed to include every part, the office of which is to cover, defend, or support the tongue.

Tubus. This part is called by Fabricius the base of the tongue, but De Geer, in his account of the *proboscis* of the *Proabeille*, considers it as distinct, naming it *the intermediate piece of the* sheath

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(*i*) Ubi supra, Tab. 25. fig. 4. 13. *c.* p. 326, 327.

(*k*) Tom. 2. p. 2. p. 1130. Tab. 26. fig. 10, 11. *bb, cc.*

(*l*) Ibid. p. 1128. Tab. 25. fig. 12. *aa, b, e.*

sheath(*m*). Swammerdam likewise names it *the sheath of the tongue*(*n*); and Latreille calls it *la gaîne.* I think it ought to be distinguished from the tongue, though it includes its base, as it differs from it in substance, in this respect resembling the *valvulæ*, and indeed performing a similar office.

Fulcrum. This part, upon which the tube sits, has been noticed both by Swammerdam and Reaumur, the former denominating it, as well as the *cardines* of the *valvulæ*, "*articulations by which the proboscis is united to the head*(*o*);" and the latter terming it *le pivot*(*p*).

Auriculæ. De Geer has noticed and figured these in the rostrum of his *Proabeille*, and calls them "*petites parties en forme de barbillons*(*q*)." They are distinguished from the *laciniæ interiores* of the genus *Apis*, by being usually lacerate at their apex.

Laciniæ exteriores. These are to be met with in all the families of the genus *Apis*, the two first excepted, and in no other *Hymenopterous* insects that I know of. They are distinguished from the two first articulations of the *interior palpi*, to which they are analogous, by being flat, instead of cylindrical

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(*m*) Tom. 2. p. 1146. Tab. 32. fig. 10. *a, b.*

(*n*) Hill's Swammerdam. Bib. Nat. Expl. Tab. p. 19. Tab. 17. fig. 5. *q.*

(*o*) Swamm. ubi sup. & Tab. 17. fig. 5. *rrrr.*

(*p*) Reaum. ubi supra, p. 334. Tab. 27. fig. 9. *q.*

(*q*) Tom. 2. P. 2. p. 1146. Tab. 32. fig. 10. and p. 757.

drical, sometimes dilated at their base, and furnished with a margin of membrane. By Swammerdam they are termed "*the second pair of joints of the proboscis* (*r*);" and by Reaumur "*les demi étuis intérieurs* (*s*)."

Laciniæ interiores. These are peculiar to *Apis*, and embrace and defend the tongue where it enters the tube. They are called by Swammerdam "*the third pair of joints of the proboscis* (*t*); Reaumur notices them as "*piéces qui embrassent et fortifient la trompe* (*u*);" Latreille, in *Nomada*, names them *soies laterales.*

Valvulæ. These form the exterior sheath of the tongue; I have divided them into *basis* and *apex*; which by Swammerdam and Reaumur seem to have been considered as distinct pieces. The former calls the basis, in conjunction with the tube, "*the joints which form the lower part of the proboscis*;" and the apex of the valvulæ "*the first pair of joints of that part* (*x*)." Reaumur denominates the latter "*les demi étuis extérieurs*," and the former "*les tiges des demi étuis extérieurs* (*y*)."

Pecten. This denotes the spines which arm one side of the upper part of the base of the valvules. These, as far as I know, are now first noticed.

(*r*) Ubi sup. p. 18. fig. 5. *f, e.* (*s*) Ubi sup. *ee.* (*t*) Ubi sup. *hh.* (*u*) Ubi sup. *gg.* (*x*) Ubi sup. *aa. qq.* (*y*) Ubi sup. fig. 9. *fi, fi, kk.*

Cardines. These intervene between the valvulæ and the lora, and seem to perform the office of hinges. They are mentioned by Swammerdam, as means, in conjunction with the fulcrum, by which the proboscis is united to the head. Reaumur terms them "*filets tendineux par les quels les tiges sont attachées à leurs appuis* (z)."

Palpi exteriores. These are not noticed by Swammerdam, though his figure of the proboscis of the hive bee gives a rude sketch of them at *d*. By Reaumur they have been entirely overlooked not only in *A. mellifica*, in which they are very minute and consist only of a single joint, but likewise in *A. violacea;* where they are very easily seen and are sexarticulate. In his genus *Proabeille* he notices them, but there confounds them with the apex of the valvulæ (*a*). De Geer denominates them "*les grands barbillons* (*b*)."

Palpi interiores. These are called by Swammerdam "*the two upper articulations of the second pair of joints of the proboscis* (*c*)." Reaumur distinguishes them by the term "*barbes*" but he did not examine them so closely as might have been expected, for in his account of the proboscis of *A. mellifica* he represents them as consisting of from three to four articulations (*d*), when, in fact, they have only two. His figures sometimes represent

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(z) Ubi supra. *oo*. (*a*) Reaum. Tom. 6. Mem. 4. p. 125. Tab. 9. fig. 7. *b*. (*b*) Ubi sup. p. 1128. (*c*) Ubi sup. *gg*. (*d*) Tom. 5. Mem. 4. p. 333.

sent them accurately in this respect (*e*). De Geer names them "*les petits barbillons* (*f*)."

Lora. These parts I have so named from their use, which seems to be to let out or pull in the proboscis; in the latter case, the angle on which the fulcrum of the tube sits points towards the breast (*g*), in the other, towards the mouth (*h*). These are named by Reaumur "*les leviers* (*i*)."

Annulus. By this term I distinguish the circumference of the *gula*, in which the *lora* terminate. The cavity of the former is the bed of the *proboscis*.

Collare. I have borrowed this term from Villars, the ingenious author of the *Entomologia Europæa*. This part often requires distinct notice in the description of the *Vespiform Apes*.

Thorax. I have judged it best to confine this term to that piece which is terminated on all sides by the dorsal sutures.

Tuberculi. These, so far as I know, have not been distinguished by a particular name. They differ from the "*punctum callosum ante alas*" of Linneus and others, and are to be found in all the species of the two genera into which I have divided *Apis*; although in most, the *Nomadæ* or *Vespiform Apes* excepted, not easily discoverable.

(*e*) Tom. 5. Tab. 28. fig. 7, 8, 9, 12, 13. *hh.* (*f*) Ubi sup. p. 1169. Tab. 41. fig. 7. *aa.* (*g*) Reaum. ubi sup. Tab. 27. fig. 8. *q.* (*h*) Ibid. fig. 9. *q.* (*i*) Ibid. p. 334. Tab. 27. fig. 9. *rr.*

They are to be found also in many other *Hymenopterous* insects.

Metathorax. In this class this is so conspicuous a part, that I wonder no author has taken notice of it. It is separated from the thorax and scutellum by sutures, and, in some instances, might perhaps supply a good generic character.

Pleura. As the word *costa*, has been usually employed to signify the strong marginal nerve of the superior wings, I have fixed upon this to denote the sides of the truncus.

Sternum. In the genera treated of in this work, this part is immersed in the breast, and is not to be discovered without taking off the fore legs.

Squamula. Linneus in his descriptions notices the part intended by this term, sometimes simply as "*punctum ante alas,*" and at others as "*punctum callosum ante alas.*" It is a corneous concavo-convex scale under which the base of the superior wings plays.

Anastomosis. The term by which this part is denoted, in the *Fundamenta Entomologiæ*, is *stigma*; but as this is also employed to signify a particular spot in the wings of some *Phalænæ*, I thought it best to alter the term, and adopt one which I have seen used, I forget by whom, to denote this part, and which seems with more strict propriety applicable to it. Linneus, indeed, himself does not adhere to his own term, using often *punctum marginale*, and sometimes *macula marginalis* instead of it.

Hamuli. These are very minute hooks or crotchets, discoverable under a good magnifier on the inferior wings of many *Hymenopterous* insects, by means of which they are kept steady in flying. They have been noticed by no author, that I have an opportunity of consulting, except De Geer, and he observed them in no genus besides *Formica* (*k*), in which they are not near so conspicuous as in *Apis*.

Apophysis. I find this term used by Schrank for the biarticulate piece upon which the thighs sit, and therefore I have retained it. *Coxa* probably might be a better term. De Geer calls the first joint of this part "*la hanche* (*l*)."

Flocculus. This woolly lock at the base of the posterior legs of one family of *Melitta* I find noticed by no author.

Spinulæ. Linneus notices these occasionally, but as if they were peculiarities of a particular species only (*m*), when in fact they attend the whole class. De Geer mentions them and calls them *spines* (*n*) or *spurs* (*o*).

Velum. This membrane, attached to the spine of

(*k*) Ubi sup. Tab. p. 1171-2. Tab. 42. fig. 3. *cc*.

(*l*) Ibid. p. 1147. Tab. 32. fig. 12. *a*.

(*m*) Viz. *Apis florisomnis*.

(*n*) Ubi sup. *p*.

(*o*) Ibid. p. 1170. Tab. 41. fig. 12. *h*.

of the anterior tibia, is figured though not particularly noticed, by De Geer (*p*).

Scopa. This term, which is used by Schrank to denote another part, to which I have given its diminutive as a name, I have adopted to signify the thick coat of hairs which externally covers the posterior tibiæ of many of these insects, by means of which they probably brush the pollen from the flowers, and in which, when they have collected, they carry it.

Corbicula. Reaumur has noticed the fringe of hairs, which this term is intended to denote, from whom, indeed, I borrowed it. He says that it forms with the cavity of the tibia "*une espéce de corbeille* (*q*)."

Manus. The anterior legs of insects are distinguished from the four posterior ones by pointing towards the head instead of the *abdomen*, I have therefore denominated their tarsus by the term *manus*.

Palma. *Planta*. *Digitus*. The first of these terms I have restricted to the elongate joint at the base of the anterior tarsus or manus, and the second to the same part of the four posterior ones, employing the word *digitus* to express the remaining articulations taken together. These parts in this genus, especially in the posterior tarsus, are so remarkable

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(*p*) Ubi sup. Tab. 32. fig. 11. interior part of *l*. (*q*) Ubi sup. p. 330. Tab. 26. fig. 2—6. *p*. and fig. 11. *p*, *ggg*.

markable as to require a separate denomination, and as there appears to be a strict analogy between the *planta* or *palma* of these insects, and the *dilated foot* or *palm* in man, &c. and the *digitus* and the *jointed toe* or *finger*, I thought it better to adopt these terms in preference to *metatarsus*, the term which Schrank has employed, but not with strict anatomical propriety, to denote this remarkable joint. Linneus, in *A. mellifica*, has mistaken the *planta postica* for the *tibia*.

Strigilis. This part, which distinguishes the base of the palma, and in *Apis* is extremely conspicuous, is a deep pectinated sinus. De Geer is the only author who notices it. He calls it simply a *curvature*, and its pecten "*une frange en brosse* (*r*)."

Scopula. This is the name by which I denominate the hairs which cover the inside of the plantæ, called by Schrank *scopa*, and by Reaumur "*la brosse* (*s*)."

Pulvillus. I have seen this term employed to denote this part by some author, whom I do not recollect. De Geer calls it "*un petit mamelon* (*t*)."

Valvæ. These have been frequently noticed. Swammerdam calls them *appendages of the sting*;

(*r*) Ubi sup. p. 1170. Tab. 41. fig. 13. *c, f, g*. (*s*) Ubi sup. p. 330. Tab. 26. fig. 6, 7. *b b*. (*t*) Ubi sup. p. 1147. Tab. 32. fig. 12. *n*.

and looks upon them as designed merely for ornament (*u*). Reaumur and De Geer term them *demi-fourreaux* (*x*). Linneus, in his character of *Ichneumon*, calls them *valves* of the *vagina* of the *aculeus*. They are the covers of the genuine *vagina*.

Vagina. This is the part that generally goes under the name of the *aculeus*; but in all *Hymenopterous* insects, even *Ichneumons*, it is no more than the sheath or quiver of the real *aculei*, as Swammerdam, Reaumur, and De Geer properly call it (*y*).

Spicula. This term I have borrowed from Virgil (*z*), to express the true *aculei*. These in Swammerdam are denominated "*the shanks of the sting* (*a*)." Reaumur and De Geer call them "*des aiguillons* (*b*)."

Retinaculum. This part of the *spicula*, which was first pointed out to my observation by my ingenious

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(*u*) Swamm. Explan. Tab. p. 20. Tab. 18. fig. 2. *qq*.

(*x*) Ubi sup. Mem. 7. p. 376. Tab. 29. fig. 1—3, 7, 9. 10. *cc*. De Geer, ubi sup. p. 1129. Tab. 25. fig. 15. *ff*, &c.

(*y*) Swamm. ubi sup. p. 20. Tab. 18. fig. 3. *a*, *b*, *c*. Reaum. ubi sup. p. 376-7. Tab. 29. fig. 4—6. *f*, &c. De Geer, ubi sup. p. 1129. Tab. 25. fig. 15. *a*.

(*z*) Illis ira modum supra est, læsæque venenum
Morsibus inspirant, et *spicula* cæca relinquunt
Affixæ venis. *Georg*. iv. l. 236.

(*a*) Swamm. ubi sup. p. 20, 21. Tab. 18. fig. 3. *dd*, &c.

(*b*) Reaum. ubi sup. fig. 5. *e*, *g*. De Geer, ubi sup. *cc*.

genious friend Mr. Marsham, seems to have caught the attention of no naturalist besides himself, and the indefatigable Swammerdam, who calls them "*cartilaginous processes serving instead of muscles to move the shanks*(c)." They seem to me rather designed to prevent them from being darted out too far.

Forceps. Swammerdam calls these *hollow appendages*(d). Reaumur usually denominates them *crochets*(e). De Geer *une pince ecailleux*(f).

(c) Swamm. ubi sup. fig. 3. *rrr*. Tab. 21, 22. fig. 1. *kk*, &c. Tab. 33. fig. 9—11. *cc*.

(d) Ibid. p. 24, 25.

(e) Ubi sup. Mem. 9. p. 516.

(f) Ubi sup. p. 1130. Tab. 26. fig. 8, 9. *a*; *b*, *c*, *d*.

MONOGRAPHIA

APUM ANGLIÆ.

PARS SECUNDA.

GENERUM ATQUE FAMILIARUM CHARACTERES

TRADENS.

Unusquisque secundum linguam suam, et familias suas in nationibus suis. Gen. x. 5.

GENERA.

IN the preceding pages, I hope, I have made it evident, that the characters at present in use to distinguish those insects, which Linneus considered as *Apes*, whether we follow his system or that of Fabricius, are not universally applicable to them: I shall, therefore, now proceed to offer my own ideas upon the subject, and to point out such characters as will most constantly distinguish the species they are designed to denote; which a close and frequent examination of the external parts of many individuals has enabled me to discover. But in order to prevent tautology, when I am drawing out the *Natural Characters* of my genera and families, that I may exclude from them such circumstances as appear to be common to all *Hymenopterous* insects, I shall previously attempt giving one of the *Hymenoptera* class.

CLASSIS HYMENOPTERA.

Character Naturalis.

CORPUS cute corneâ cataphractum.

CAPUT. *Os* proboscide 3—7-fidâ, linguâ, ejusque vaginâ, constante.

Lingua centralis, cartilaginea.

Vagina 2—6-valvis.

Valvulæ duæ basi corneæ, e latere palpigeræ.

Tubus corneus.

Palpi quatuor, cornei, inæquâles.

Exteriores 1—6-articulati, e valvularum latere erumpentes.

Interiores 1—4-articulati.

Vertex stemmatibus tribus lucidis (*a*).

Maxillæ transversæ, corneæ.

Labium figurâ varium, proboscidem cohibens.

TRUNCUS. *Alæ* plerisque quatuor, incumbentes, membranaceæ, nudiusculæ, nervis sæpius validioribus interstinctæ.

Superiores majores, basi squamulâ munitæ.

Inferiores margine anteriori hamulis haud rarò instructæ.

Pedes sex, apophysi biarticulatæ articulis conicis insidentes.

Tibiæ apice spinulis 1—2 armatæ.

Tarsi quinquearticulati, articulo primo sæpius elongato, extimo unguiculato.

ABDOMEN. *Anus* feminis et neutris aculeatus.

(*a*) In *Formica* and *Mutilla*, in most of our English species, the males and females, or winged sexes, only have stemmata, in the neuter they are obsolete; their place, in some instances, is supplied by three points slightly impressed.

Aculeus valvis duabus, vaginâque univalvi spicula duo exerente, constans (*l*).

When I first turned my attention to the subject of these pages, I thought of denoting all the species described in them by one generic character: but the more I studied them, the more strongly was I convinced that they belonged to two natural genera, essentially distinguished from each other; and this idea was further confirmed, when I found that Reaumur, and after him De Geer, had adopted the same opinion; although they did not sufficiently extend the limits of the genus, which they denominated *Proabeille*, for the insects that may be arranged under it are equally numerous with the genuine *Apes*. The characters which form the most striking distinctions of these two genera are furnished by the tongue; which organ, in the one, is short, flattish, usually acute with a lateral auricle, and not inflected; and in the other, elongate, slender, cylindrical, and inflected. The first of these distinguishes the *Proabeilles*, or *Apes minùs propriè dictæ*; and the other such as are genuine *Apes*.

De Geer has given the name of *Nomada* to those insects which, after Reaumur, he separated from

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(*l*) Linneus, in his essential character of the genus *Formica*, calls their *aculeus* obsolete. De Geer represents the species of his first family as having no aculeus, and those of his second as armed with that instrument. Tom. 2. P^ie^. 2. Mem. 18.

Apis: this name is also used by Scopoli; but as it has been usually employed by Fabricius and his followers to denote a very different family of *Apes*, the adoption of it might occasion some confusion. To avoid this I have called it *Melitta*, the Attic dialect of *μελισσα*, the Greek name for *Apis*, which itself is pre-occupied in botany.

I shall now proceed to give the *Essential*, *Artificial*, and *Natural Characters* of both genera, beginning with

MELITTA. *Character Essentialis.*

Aculeus punctorius. *Lingua* apice brevis, porrecta, planiuscula, vaginâ subcylindricâ.

Character Artificialis.

Os proboscide subcylindricâ, porrectâ, linguam brevem, planiusculam, exerente.

Antennæ mediæ, aculeatis subclavatæ articulis 13; maribus filiformes articulis 14.

Oculi laterales, sub-ovales, integri.

Alæ planæ.

Aculeus punctorius, reconditus.

Character Naturalis (c).

CAPUT. *Os* proboscide subcylindricâ, trifidâ aut quinquefidâ.

(c) Tab. 1—4.

Lingua apice brevis, planiuscula, acuta, vel acuminata, interdum sed rariùs truncata, est ubi bifida; plerisque utrinque auriculata.

Vagina

Tubus apice tridentatus.

Valvulæ lineares sub apice palpigeræ, basi sæpe elongatæ, corneæ, apice breves, coriaceæ, inflexæ,

Palpi setacei.

Exteriores sexarticulati.

Interiores quadriarticulati.

Antennæ mediæ, aculeatis breves, subclavatæ, fractæ, articulis 13; maribus tenuiores, longiores, filiformes, vix fractæ, articulis 14.

Oculi laterales, sub-ovales, integri, reticulati.

TRUNCUS. *Alæ* planæ, cruciato-incumbentes.

Superiores subcuneiformes apicibus obliquis.

Inferiores hamulis instructæ.

Pedes cursorii, anteriores intermediis, intermedii posterioribus breviores.

Femora clavata.

Tibiæ clavatæ, subtrigonæ, extrinsecùs convexæ, anticis et intermediis apice spinulâ unicâ, illarum velatâ, posticis duabus, armatis.

Palmæ basi strigile intus instructæ, segmento circuli dempto.

Plantæ, posticæ præcipuè, scopulâ intus vestitæ.

Ungues unguiculis bifidis in omni sexu.

ABDOMEN. *Tergum* aculeatis sex segmentorum, maribus septem.

Aculeus sæpius punctorius, subulatus, retractilis.

Obs. Corporis pili plerumque plumosi.

Larva apoda, carnosa, plicata, supra convexa, subtus planiuscula, cellulis subterraneis ut plurimùm degens, polline antherarum melle mixto sæpius enutrita.

Pupa incompleta, folliculo inclusa.

Imago mellisuga, sæpius pollinilega.

APIS. *Character Essentialis.*

Aculeus punctorius. *Lingua* elongata, inflexa (*d*).

Character Artificialis.

Os prodoscide fractâ, inflexâ, linguam cylindricam, elongatam, exerente.

Antennæ mediæ, aculeatis articulis 13; maribus articulis 14.

(*d*) The Hebrew name of the bee דבורה, derived from דבר, to speak, seems to direct us to the *tongue* for its *Essential Character.*

Oculi laterales, subovales, integri.
Alæ planæ.
Aculeus punctorius, reconditus.

Character Naturalis (e).

CAPUT. *Os* proboscide elongatâ, fractâ, inflexâ, 5—7-fidâ.
Lingua elongata, tenuis, cylindrica, sæpius pilosa, transversè striata.
Vagina
Tubus linearis.
Laciniæ plerisque quatuor.
Exteriores elongatæ, biarticulatæ, planiusculæ, paulò infra apicem palpigeræ (f.)
Interiores plerumque breviores, membranaceæ, linguam apud tubum amplexantes.
Valvulæ lineares, angustæ, medio e sinu laterali palpigeræ, basi corneæ, apice sæpius coriaceæ, inflexæ.
Palpi Exteriores 1—6 articulati.
Interiores 1—4 articulati.
Antennæ mediæ, aculeatis articulis 13; maribus articulis 14.
Oculi laterales, subovales, integri, reticulati.

(e) Tab. 4—13.

(f) In my two first families of this genus the exterior laciniæ are wanting.

TRUNCUS subglobosus.

Alæ cruciato-incumbentes, planæ.

Superiores subcuneiformes apicibus obliquis.

Inferiores hamulis instructæ.

Pedes cursorii, anteriores intermediis, intermedii posterioribus breviores.

Femora clavata.

Tibiæ subclavatæ, trigonæ, extrinsecùs convexæ, anticis et intermediis apice spinulâ unicâ, illarum velatâ, posticis duabus(*g*), armatis.

Palmæ basi strigile intus instructæ, segmento circuli dempto.

Plantæ, posticæ præcipuè, scopulâ densâ intus vestitæ.

ABDOMEN. *Tergum* aculeatis segmentis sex, maribus plerumque septem (*h*).

Aculeus punctorius, subulatus, retractilis.

Obs. Corporis pili plumosi.

Larva apoda, mollis, plicata, supra convexa, subtus planiuscula.

Pupa incompleta, folliculo inclusa.

Imago mellisuga, sæpius pollinilega, interdum cerifica.

That there is an essential distinction between *Melitta* and *Apis*, the above characters will, I hope, satisfac-

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(*g*) The posterior tibiæ of all sexes of *A. mellifica* are without spines. This is the only insect in the class *Hymenoptera*, that I have examined, in which this defect occurs.

(*h*) In the males of one family of this genus the seventh dorsal segment of the abdomen is usually obsolete.

satisfactorily demonstrate to the learned entomologist; especially if he will take the trouble to consider attentively the set of plates belonging to each genus: and though the principal difference lies in the tongue, he will experience but little difficulty in determining to which any particular individual ought to be referred; for the long, inflected, cylindrical, and often subinvolute tongue of a genuine *Apis*, is usually very easily examined without the assistance of a lens; all that is necessary in most species is with a pin, when it is concealed by them, to lift up the valvulæ. In some species of *Melittæ*, which seem intermediates of the two genera, the apex of these is nearly as long as the base (*i*); and as the former are inflected, these might be mistaken for *Apes*; but the tongue will not be found inflected under the valvulæ. Indeed, a little practice will enable any one to distinguish the species of each genus, without even this trouble; especially when he becomes conversant with the characters of the several families into which it may be subdivided. I should recommend it strongly to every collector to take the pains to unfold the proboscis of such individuals as he may collect, this is easily done with a pin before the insect stiffens, and it may be made to continue unfolded by being set out, and its various parts separated, by pins or braces of card.

But though it is so easy to distinguish these two genera from each other, it may not be equally easy

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(*i*) Tab. 3. **. c. fig. 9. *a*.

to separate them, *Melitta* especially, from others. Had I thrown out the two first families of that genus, one of which has a bifid and the other a truncate tongue, all difficulty would have vanished, for the acute tongue of the rest furnishes a peculiar and striking characteristic: but as it was my wish to avoid, as much as possible, all unnecessary multiplication of genera, I was unwilling to do this, especially as these families seem more nearly related to *Melitta* in habit than to any other genus. The genera, to which by the form of their tongue they are somewhat approximated, are *Crabro* and *Philanthus* of Fabricius; but in *Crabro* the proboscis is shorter, triangular rather than cylindrical. The valvulæ are more dilated, and rounded at the apex, and the palpi are thickest in the middle. The eyes, likewise, in that genus are very large, subtriangular, and by no means lateral. The antennæ are anterior, and of a different form. *Philanthus* may readily be distinguished from those *Melittæ* which it somewhat resembles in the form of its tongue, by the hairy lateral angles of that organ. Besides, the apex of its valvulæ is not plicate, its body is without hair, and the sides of its abdomen are crenate (*k*).

The only genus, I am at present acquainted with, which, like *Apis*, has an inflected proboscis, is *Ammophila*; but this is strikingly distinguished by its clavate tongue, bifid at its apex with acute

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(*k*) Tab. 14. n. 5 and 7, compare with Tab. 1. *. a. b.

lobes. The apex also of its valvulæ is semisagittate (*k*); besides, its general habit will at first sight evince its difference from all *Apes*.

Having done with the generic characters of *Melitta* and *Apis*, I am now to proceed to the mention of those distinctions which divide them into families. In this part of my undertaking my aim has not been so much to fix upon artificial characters, which often disunite those insects which nature has put together, but to discover whether the ALL WISE AUTHOR of nature, who is a GOD of order, has not subdivided these genera, and impressed certain common characters upon such subdivisions, by which one who studies his works under no influence but the love of truth, and led by the single desire of finding out HIS system, might be enabled to arrange them according to their natural affinities.

My first step was to place together all those individuals, which appeared to me to agree in habit, adopting the sentiment of Linneus, that habit would often lend a clue to discover nature (*l*). At first, of course, I made many mistakes, often placing, as all who, with Fabricius, rely solely on habit for the arrangement of species, will inevitably do, the males in one subdivision, and the females in

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(*k*) Tab. 14. n. 9, with Tab. 5—13.

(*l*) *Habitus, uti in quadrupedibus distinguit feras a pecoribus quamvis dentes non inspicerentur, sic etiam in plantis sæpius harum ordines naturales primo intuitu manifestat.* Lin. Philos. Bot. § 163.

in another. By pursuing this method, however, I got my species into some order, and they were arranged, the above great mistake excepted, very nearly according to their natural affinities. I then proceeded to examine the proboscis, and external anatomy of those which were found to agree in habit, and by this method I soon arrived at their distinguishing characters, and was enabled to detect those marks, exclusive of the organs of generation, which are the constant characteristics of the males in these genera. I found that some of those insects which I had considered as belonging to distinct families, had invariably one joint more in their antennæ, and generally one segment more in their abdomen than others (*m*), that their bodies were proportionably narrower, and their antennæ and legs longer and more slender. It soon occurred to me that these were only sexual distinctions, an idea which was confirmed by pressing the anus of such as I had an opportunity of taking alive, and inspecting their *genitalia*. The mistake above alluded to was in this manner rectified; and, instead of confusion, lucid order now took place in my arrangement. Thus, beginning with habit and

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(*m*) Both these circumstances, with respect to some individuals in this class, have been noticed by De Geer, but he did not follow up this discovery, and examine whether it would hold good in the whole genera. My observations were made before I was aware that this illustrious author had made the above discovery. De Geer, 2. p. 2. pp. 772. 796. 817.

ending with anatomy and economy; descending from generals to particulars, and then tracing back my steps from particulars to generals; using both the synthetical and analytical modes of reasoning, as mathematicians speak, by a series of observations and experiments, frequently repeated, I was enabled to trace the labyrinth of nature, and, by the assistance of this double *filum Ariadneum*, to establish my system upon a sure basis. I do not pretend, however, to have exhausted the subject, much will still remain to be done, and much improvement may be given to what is here attempted, by those who possess the opportunity of examining the exotic species of these two genera; but, I hope, I have opened the way for the discovery of the natural arrangement.

I shall first draw out a synoptical table of my families and their subdivisions, exhibiting at one view their *Essential Characters*, and next offer some observations upon each, with a general account of its history and economy, as far as I am at present acquainted with them, prefixing what may be called its *Natural Character*, or *Habitus*. To enable my readers to determine with greater facility to what division any particular insect belongs, in my *Synopsis Specierum*, I shall place at the head of each family an *Artificial Character* of it.

FAMILIARUM ſ. ORDINUM SYNOPSIS.

MELITTA. * *Linguâ* obtusâ.
a. *Linguâ* obtusâ, apice bilobâ (*n*).
b. *Linguâ* obtusâ, apice truncatâ(*o*).
* * *Linguâ* acutâ.
a. *Labio* inflexo, emarginato (*p*).
b. *Labio* appendiculato, appendiculâ inflexâ (*q*).
c. *Labio* obtusangulo, tuberculo munito (*r*).

APIS. * *Proboscide* laciniis exterioribus nullis (*s*).
a. *Antennis* subclavatis in omni sexu (*t*).
b. *Antennis* filiformibus in omni sexu (*u*).
* * *Proboscide* laciniis exterioribus instructâ(*x*).
a. *Palpis* exterioribus 5-articulatis. *Labio* subquadrato (*y*).
b. *Palpis* exterioribus exarticulatis. *Labio* anticè curvo (*z*).
c. *Labio* inflexo, elongato (*a*).
1. *Ventre* femineo glabro.
α. *Abdomine* femineo conico, acutissimo (*b*).

(*n*) Tab. 1. *. a. fig. 2, 3. (*o*) Ibid. *. b. fig. 1. (*p*) Tab. 2. **. a. fig. 4. (*q*) Ibid. **. b. fig. 4, 5. (*r*) Tab. 3. **. c. fig. 10, 11. (*s*) Tab. 4. *. a. fig. 4. Tab. 5. *. b. fig. 3. (*t*) Tab. 4. *. a. fig. 8, 9. (*u*) Tab. 5. *. b. fig. 16, 17. (*x*) Tab. 5—13. (*y*) Tab. 6. **. a. fig. 1. *g*. & Tab. 5. **. a. fig. 7. (*z*) Tab. 6. **. b. fig. 4. *d*. & fig. 6. (*a*) Tab. 7—10. (*b*) Tab. 7. **. e. 1. α. fig. 11, 12.

β. *Abdomine* femineo subcylindrico, obtuso (*c*).
2. *Ventre* femineo hirsuto (*d*).
α. *Palpis* omnibus biarticulatis (*e*).
β. *Palpis* exterioribus exarticulatis (*f*).
γ. *Palpis* interioribus exarticulatis (*g*).
δ. *Palpis* exterioribus 4-articulatis (*h*).
d. *Proboscide* rectâ, apice subulato-conicâ; palpis exterioribus 6-articulatis (*i*).
1. *Laciniis* interioribus involutis, exteriorum longitudine (*k*)
2. *Laciniis* interioribus rectis, quàm exteriores brevioribus (*l*).
α. *Labio* quadrato inermi (*m*).
β. *Labio* emarginato, tuberculo munito (*n*).
e. *Proboscide* subinvolutâ, palpis exterioribus exarticulatis (*o*).
1. *Corpore* villoso (*p*).
2. *Corpore* hirsutissimo (*q*).

I could have wished that there had been more connection and harmony between the characters

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(*c*) Tab. 7. **. c. 1. β. fig. 4, 5.
(*d*) Tab. 8. fig. 22.
(*e*) Ibid. fig. 2. *d*; *f*. fig. 3. *c*.
(*f*) Tab. 9. **. c. 2. β. fig. 2. *dd*. & fig. 4.
(*g*) Ibid. c. 2. γ. fig. 3. *dd*. & fig. 5. *b*.
(*h*) Tab. 10. **. c. 2. δ. fig. 3. *a*.
(*i*) Tab. 11. **. d. 2. α. fig. 3. *d*. & fig. 2.
(*k*) Tab. 10. **. d. 1. fig. 2. *bb*.
(*l*) Tab. 11. **. d. 2. α. fig. 1. *ff*.
(*m*) Ibid. fig. 5.
(*n*) Ibid. fig. 20.
(*o*) Tab. 13. fig. 1. *kk*. fig. 4—6.
(*p*) Tab. 11, 12.
(*q*) Tab. 13.

of the different families of *Apis*, and that it had been in my power to have drawn them all from variations of the same part, but this was not possible, without doing the utmost violence to nature. To make this evident, to the satisfaction of the judicious naturalist, I will draw out a scheme of an artificial division of the species of this genus, in which all the characters of the families and their subdivisions shall be taken from the exterior and interior palpi, and he will see what confusion will be the result.

APIS. * *Palpis* exterioribus sexarticulatis.
 a. *Palpis* interioribus quadriarticulatis.
 b. *Palpis* interioribus biarticulatis.
** *Palpis* exterioribus quinquearticulatis.
*** *Palpis* exterioribus quadriarticulatis.
**** *Palpis* exterioribus biarticulatis.
 a. *Palpis* interioribus biarticulatis.
 b. *Palpis* interioribus exarticulatis.
***** *Palpis* exterioribus exarticulatis.

This scheme looks very fair and harmonious upon paper, but if we arrange our *Apes* according to it, our cabinets will exhibit a scene of confusion and discord. *Apis violacea* and its affinities will be separated from the *Bombinatrices*, to which they are most nearly allied, and be placed by the side of the *Vespiform Nomadæ*, which they resemble in nothing but the number of the articulations of the exterior palpi: the whole natural family distinguished by an inflected lip, will be broken up; and *Apis manicata* and *variegata* will go into the same family with the *Bombinatrices*.

I shall now proceed, as I proposed above, to offer a few observations on each family, with some account of its history and economy, preceded by a synopsis of its peculiar characters.

MELITTA. *. a. (r)

Hujus Familiæ Aculeatis *Corpus* oblongiusculum, villosum; *Capite* trunci latitudine, subtriangulari; *Proboscide* glabriusculâ; *Linguâ* tubulosâ, bilobâ lobis divaricatis, apice laceris; *Tubo* conico, apice tridentato; *Valvulis* apice plicato, rotundato, margine exteriori ciliato, basis longitudine; *Annulo* subrotundo; *Stemmatibus* in lineâ curvâ; *Oculis* distantibus; *Labio* anticè obtusangulo; *Maxillis* subedentulis; *Antennis* basi approximatis, scapo elongato, pedicello subgloboso, apice articulo primo conico; *Trunco* subgloboso; *Pedibus*, posticis præcipuè, polliniferis; *Abdomine* declivi, vel ovato, vel subconico, acuto.

Maris *Corpus* angustius. *Maxillæ* apice bidentatæ. *Pedes* minùs villosi.

I have placed this family at the head of the genus because, in the form of its tongue, it approaches to *Philanthus*, as observed above, and also to *Vespa*. The shape of this organ seems calculated to assist it in the construction of the membranaceous cells, which the Wise Author of nature has instructed it to form to receive its eggs. I have not been fortunate enough to meet with its nidi myself; but Reaumur has given a very entertaining account of them, which, as his work is not in every bodies hands, I cannot do better than abridge. It is contained in the fifth Memoir of his sixth volume, upon those bees "*dont les nids sont faits d'especes de membranes soyeuses.*" From the figure which he has given of the proboscis and of the insect (*s*), there can be no doubt of his intending an individual of this family. "They make their nests," this author informs us, "in the earth that fills the vacuities of certain stone walls: some of them choose a northern aspect sheltered by trees. These nests are cylindrical, and consist of from two to four cells, placed end to end, each of which is shaped like a thimble, the end of the second fitting into the mouth of the first: the cells are not all of an equal length, some being five, others only four lines long: their diameter is about two lines. The cylinder usually runs in a horizontal direction, but sometimes, from the intervention of a stone or other obstacle, it takes a different course, so that the last cell or cells form an angle with the first: it is distinguished by transverse bands of different colours; the narrowest bands, which are at the junction of the cells, are white; the broadest,

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(r) Tab. 1. *. a. *Andrena*, Fab. Latr. *Des Abeilles dont les nids sont faits d'especes de membranes soyeuses*. Reaum.

(*s*) Reaum. tom. 6. Mem. 5. p. 131—139. Tab. 12. fig. 1—13.

which point out their body, are reddish brown; between these are others, some inclining to red, and others to brown. The cells are composed of many layers of a very thin and transparent membrane; the red colour arises from the substance with which they are replenished; this is sometimes nearly liquid, at others it is merely a paste made of pollen and honey. After the larva is hatched it soon imbibes all that is liquid, and when arrived at its full dimensions, it quite fills its cell: it resembles the larva of the hive bee. Whence these bees procure the membrane with which they form their cells our author could not ascertain, but he conjectures it to be a secretion of the insect analogous to what is used by many others for similar purposes." Thus far Reaumur.

Grew seems to have met with the nidi of one of these bees in a singular situation; the following are his words. "Another sort of wild bee with their bags. They are about half an inch long, of a cylindrical figure, very thin and transparent like the inner coats of the eye, admirably placed for warmth and safety; sc. lengthways one after another in the middle of the pith of an old elder branch, with a thin boundary betwixt each bag. The little bees are somewhat thicker than the flying ant, and their bellies marked with four or five white rings (*t*)."

(*t*) Grew's Rarities, § 7. c. i. p. 154.

Willughby, also, appears to have found the nidi of one species of this family; for in his description of his "*Apis sylvestris in terrâ foramen sibi fodiens,*" in Ray's *Historia Insectorum* (u), he says, "*nullas omnino nymphas inveni, sed cellas quasdam rotundas ex albâ et tenui cute, in quibus mel densum sordidum*;" which words evidently describe the membranous cells of the insects of this family. His description of the individual seems to point out our *Melitta fodiens,* which I believe nidificates under ground. Of his insect he observes, "*Multæ simul habitant et foramina in terrâ fodiunt, terram egerentes ad modum vermium.*"

I have found the males of one species of this family fluttering about a southern bank, when the sun shone; but though I took some pains, I could discover no nest, nor a single individual of the other sex. I have seen only two species taken in England, but I believe there are several foreign ones: there is one in the Linnean cabinet labelled *Apis marginata,* and I think I observed others in Sir Joseph Banks's collection. They appear with us in the autumn, about the time that *Senecio Jacobæa* is in flower. Reaumur supposes that two generations of them are produced in the course of twelve months, from one spring to another.

(u) P. 244.

*. b. (x)

H. F. A. *Corpus* sublineare, glaberrimum; *Capite* trunci latitudine, subtriangulari; *Proboscide* brevi, crassiusculâ, glabrâ; *Linguâ* brevissimâ, truncatâ, utrinque auriculatâ; *Tubo* conico, apice tridentato, dente intermedio majori; *Valvulis* apice lanceolato, acuto; *Annulo* subrotundo; *Facie* maculatâ; *Stemmatibus* in triangulo; *Oculis* distantibus; *Naso* distincto, planiusculo, apice truncato; *Labio* anticè obtusangulo; *Maxillis* apice bidentatis; *Antennis* pedicello, apicisque articulo primo, subconicis; *Trunco* ex ovali-oblongo; *Alis* anastomosi magnâ; *Abdomine* subconico, declivi, basi subretuso, supra gibbo.

Maris *Corpus* paulò angustius. *Facies* infra antennas albida aut lutea.

Historia et oeconomia adhuc latent. Imago vix pollinilega, odore *Melissæ* ſ. potiùs *Dracocephali Moldavici* gratissima.

The present, as well as the preceding family, departs a little from the genuine character of *Melitta*, and it is not without some hesitation that I have retained them in that genus, the tongue in all the other families being acute. Hereafter, perhaps, when the class *Hymenoptera* comes to be more attentively studied and better understood, it may be found necessary to separate these two families from *Melitta*: in the mean time, as they

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(x) Tab. 1. *. b. *Hylæus*, Fab. and Latr.

appear to be more nearly connected with that genus than any other, it seemed to me most adviseable to consider them as belonging to it, and connecting it with other genera. Two species of the present family have been figured by Panzer as *Spheces* (y); but though their tongue bears some resemblance to that part in some of the Linnean species of *Sphex*, or the *Crabro* of Fabricius, the proboscis, valvulæ, and palpi, as well as the eyes, and the antennæ with respect to their situation, are different, and are those of genuine *Melittæ.* Linneus regarded the several species of this family, as far as he was acquainted with them, as mere varieties of *Apis annulata*; but the characters of families have so often been mistaken for diagnostics of a single species, as I shall have occasion to prove more at large hereafter, that this need not be wondered at. The dilated scapus of the antennæ, which distinguishes, in so remarkable a manner, the male of one species (z), while the same sex of others have it not, must be the mark of more than a variety.

The insects of this family appear to be furnished with no apparatus for conveying pollen. They most commonly frequent the flowers of the different species of *Reseda*, and do not usually make their appearance till they are in blossom. When pressed between the fingers, they emit a powerful, and at the same time agreeable, odor, resembling the scent of Balm, or rather *Dracocephalum Moldavicum* (*a*).

(y) *Sphex annulata*, Panz. Fn. Germ. Init. n. 53. Tab. 1. and *Sphex signata*, ibid. Tab. 2.

(z) Tab. 1. *. b fig. 8.

(*a*) I have often thought that if gentlemen, who amuse themselves with chemical experiments, would direct their attention to insects, it might lead to the discovery of some powerful medicines. The variety of strong scents, which these little creatures emit, is wonderful. I remember once, when I was walking with the ingenious Mr. Sowerby, we took a petiolated *Sphex*, nearly related to the *S. gibba* of Villars, (Ent. Eur. 3. n. 23.) if it be not the same, and to the *Crabro U flavum* of Hellwig, (Panzer. Fn. Germ. Init. n. 17. tab. 20.) and were much struck with the very stimulating effluvia of æther which issued from it, when slightly pressed. This insect is extremely common upon umbelliferous plants, and might with ease be collected in considerable numbers. Few entomologists are ignorant that a delightful odor of roses is diffused by *Cerambyx moschatus*; this is sometimes so copious as to fill a whole apartment. Many *Melittæ*, besides those of this family, have a strong scent, in some approaching to that of garlick or onion. The same remark may be extended to a number of *Ichneumons*, which emit a most powerful, but at the same time not very agreeable, scent. A most singular mixture of the odor of spices, with something indescribably fetid, proceeds from *Staphylinus brunipes*, Fab. The universal use of *Meloe vesicatorius*, the most active of stimulants, is a sufficient and well-known proof of the powerful effects which insects are capable of producing upon the human frame. A circumstance which ought to encourage us to inquire further into the virtues of which they may be possessed. The ancients seem to have had recourse to more than one species in medicine, for the *Heliocantharus* or *Scarabæus solaris*, which was probably the *Scarabæus pilularius* of Linneus, is said to have been a remedy in quartan agues. See Scapulæ Lex. under Κανθαρος.

**. a. (*a*)

H. F. A. *Corpus* oblongiusculum, subpilosum; *Capite* trunco latiori, rotundato; *Proboscide* angustâ, glabrâ; *Linguâ* acutâ, utrinque auriculatâ; *Tubo* conico, apice obsoletè tridentato; *Valvulis* apice brevissimo, obtuso, ciliato, intus fisso; *Palpis* interioribus fractis, articulo primo longiori, arcuato, incurvo; *Annulo* lineari; *Stemmatibus* in triangulo; *Oculis* distantibus; *Naso* inæquali; *Labio* inflexo, anticè emarginato, setis ciliato; *Maxillis* forcipatis, apice bidentatis dente exteriori longiore; *Antennis* approximatis, scapo elongato, pedicello subgloboso, apice articulo primo subconico; *Trunco* ovato; *Metathorace* ruguloso, inæquali; *Abdomine* subovato, supra gibbo.

Maris *Corpus* angustum, subcylindricum. *Facies* infra antennas tomentosa. *Labium* angustius, anticè subemarginatum. *Maxillæ* edentulæ. *Antennæ* submoniliformes.

Imago pollinilega.

From an insect of this family Reaumur constructed the genus which he has called *Proabeille*. It begins what I regard as legitimate *Melittæ*, distinguished by an acute tongue, furnished on each side with a membranaceous auricle, the three last joints of the interior palpi forming an angle with the first. By the assistance of this tongue, as I

(*a*) Tab. 2. **. a. *Proabeille,* Reaum. *Nomada,* De Geer, Scop. and Fab.

conjecture, the individuals of this, and the remaining families of the genus, render even and smooth the sides of the cells which they excavate for their young, and besmear them with a kind of gluten to prevent their falling in. The *Melittæ* now before us, though possessed of all the genuine characters of that genus, have a primâ facie resemblance to *Sphex*, arising principally from the paucity of their hairs. This, probably, induced Linneus to consider one species as belonging to that genus. De Geer has given a figure both of the proboscis and of the lip of one of these insects (*b*). They make their nests in bare sections of banks exposed to the sun and nearly vertical: these usually swarm with their little burrows, which they excavate, according to Reaumur, to the depth of nine or ten inches, and in which they deposit their egg, inclosing with it a small mass of pollen moistened with honey (*c*). They are common during the summer months.

**. b. (*d*)

H. F. A. *Corpus* oblongiusculum, villosum; *Capite* trunco paulò angustiori, subtriangulari; *Proboscide* angustâ glabrâ; *Linguâ* acutâ, utrinque auriculatâ; *Tubo* conico, apice tridentato dente intermedio emarginato; *Valvulis* apice brevissimo,

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(*b*) De Geer, tom. 2. p. 2. tab. 32. fig. 7, 8. *l.*

(*c*) Reaum. tom. 6. Mem. 4. p. 96, 97.

(*d*) Tab. 2, 3. **. b. *Hylæus* and *Apis*, Fab.

vissimo, obtusiusculo, ciliato, intus fisso; *Palpis* interioribus fractis, articulo primo longiori, arcuato, incurvo; *Loris* proboscidem longitudine æquantibus; *Annulo* lineari; *Stemmatibus* in lineâ curvâ; *Oculis* distantibus; *Naso* convexo, distincto; *Labio* anticè setoso-pectinato, appendiculato, appendiculâ inflexâ; *Maxillis* apice bidentatis; *Antennis* approximatis, scapo elongato, pedicello subgloboso, apice articulo primo conico; *Trunco* sæpius ovato; *Tibiis* posticis scopâ haud densâ polliniferâ, spinulis serrulatis; *Abdomine* subovali, ano rimâ perpendiculari, segmento ultimo minutissimo.

Maris *Corpus* cylindricum. *Nasus* apice plerumque albido, aut luteo. *Labium* angustum lineare, appendiculâ nullâ. *Maxillæ* edentulæ, acutæ. *Antennæ* articulis subarcuatis. *Tibiæ* posticæ scopâ nullâ. *Abdomen* lineare ano integro.

Imago pollinilega.

This family is distinguished from all others by some very striking peculiarities: the intermediate tooth of the tube is emarginate; the lora are as long as the rest of the proboscis; the lip, in one sex, is furnished with a singular appendicle; and the apex of the abdomen has the appearance of a cleft perpendicular to the horizontal fissure of the anus. The males are all remarkable for an elongate cylindrical body, and, as I observed before, have been considered by Fabricius as belonging to his genus *Hylæus:* they are extremely similar to those of the preceding family; but the extraor-

dinary length of the lora, the different form of their lip, and the white tip of the nasus, will sufficiently point them out. The wings of some of the smaller species are most splendidly decorated with the hues of the heavenly bow. The insects of this, nidificate much in the same manner with those of the preceding family, in bare banks: it includes *Hylæus albipes, arbustorum, abdominalis, cylindricus, annulatus, interruptus,* and *Apis subaurata* and *flavipes* of Panzer's elegant work, in the two last, which are of an aculeate sex, he has noticed the anal rima (*e*),

* *. c. (*f*)

H. F. A. *Corpus* oblongum, villosum; *Capite* trunci latitudine, nunc rotundato, nunc subtriangulari, depressiusculo; *Proboscide* crassiusculâ villosâ; *Linguâ* utrinque auriculatâ, auriculis linguæ lateribus sæpius perpendicularibus, unde hastata evadit, apice reflexo *f.* sursum plicatili; *Tubo* lineari, apice tridentato dente intermedio majori; *Valvulis* apice semicordato, acuminato, brevi, est ubi cultriformi, ciliato; *Palpis* interioribus fractis, articulo primo longiori, arcuato, incurvo; *Annulo* subovato; *Stemmatibus* in triangulo, interdum et in lineâ curvâ; *Naso* convexo, distincto; *Labio* antice

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(*e*) Fn. Germ. Init. n. 7. t. 15. n. 46. t. 14. n. 53. t. 18. n. 55. t. 2, 3, 4. n. 56. t. 4. 17.

(*f*) Tab. 3, 4. **. c. *Andrena, Apis, Nomada,* Fab. *Des Abeilles qui creusent la terre pour y faire leur nids.* Reaum.

anticè obtusangulo, supra tuberculo munito; *Maxillis* apice bidentatis dentibus obtusis; *Antennis* pedicello subgloboso, apice articulo primo sæpius longiori, basi attenuato; *Trunco* subgloboso; *Pedibus* posticis basi flocculo instructis; *Tibiis* ultimi paris scopâ densâ polliniferâ vestitis; *Plantis* dilatatis; *Abdomine* plerisque ovali *f.* elliptico, ano rotundato, fimbriato.

Maris *Corpus* angustius. *Caput* sæpe thorace latius. *Maxillæ* interdum edentulæ. *Pedes* et flocculo et scopâ destituti. *Plantæ* vix dilatatæ. *Abdomen* sæpius lanceolatum, ano nudo.

Imago pollinilega.

The individuals of which this family consists are very easy to distinguish from those of any of the preceding. The proboscis is downy and thicker, the auricles are nearly perpendicular to the sides of the apex of the tongue, which, when the proboscis is folded, instead of retaining its direction to the maxillæ and lip, as in other *Melittæ*, or forming the exterior fold of that organ as in *Apis*, is reflected or folded upwards pointing towards the tube (*g*), so as to form the interior fold, or that next the head: the lip in these insects is strengthened by a tubercle, the posterior legs of the aculeate sex have a flocculus at their base, the tibiæ a thick scopa, and their anus is covered by a fringe of hairs.

The species of this family usually nidificate under ground in a light soil, some choosing grass

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(*g*) Tab. 3. **. c. fig. 5. *b*.

banks over which bushes are scattered, others bare perpendicular sections, but all seem to delight in a south aspect. They excavate cylindrical burrows from five inches to near a foot in depth, and of a diameter sufficient only for the *Melitta* to go in and out at. When they make these holes, they remove the earth grain by grain which forms a small hillock near the mouth; they sometimes run in a perpendicular, and at others in a horizontal direction. The cell at the bottom of these burrows, they replenish with pollen made into a paste with honey, and in this they deposit their eggs. The pollen they carry not only upon the scopa of their posterior tibiæ, but also upon their flocculus, and the hairs of their metathorax. I have often been highly amused with seeing the female sitting and sunning herself at the mouth of her burrow, while the male kept wheeling round and round her, sometimes very near, and sometimes at a distance, with great velocity. When the female has committed her egg to the pollen paste she stops the mouth of her burrow very carefully, to prevent the ingress of ants and other insects (*h*). I suspect that Reaumur's *Abeilles Tapissières* appertain at least to this genus. His account of their mode of nidification is so very curious, that I cannot resist the temptation of inserting an abridgment of it, although I cannot find that any species, nidificating

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(*h*) Vid. Reaum. tom. 6. Mem. 4. p. 93—96.

in the manner he has described, have been discovered in England.

"It usually excavates," says he, "its little burrows in a path-way to the depth of nearly three inches, they are cylindrical to within seven or eight lines of the bottom where the animal gives it a form which approaches to hemispherical. When the ingenious architect has given its little apartment its due proportions and dimensions, and made the walls even, for their covering she prepares a splendid kind of tapestry, selecting the scarlet flowers of the wild poppy for this purpose; from these, with great dexterity, she cuts pieces of a proper form and size, which she conveys to her cell, and beginning at the bottom, with no small care and skill, overlays the walls of the mansion, destined for the habitation of her future progeny, with this hanging, as singular as it is brilliant. Sometimes this covering not only overlays the interior of the cell, but also an extent of some lines round its orifice. The bottom is rendered warm by three or four coats of poppy leaf, and the sides have never less than two. The little upholsterer, having completed the hanging of her apartment, next fills it with paste made of pollen and honey to the height of seven or eight lines, and then, after committing an egg to it, she closes its mouth with earth so nicely, that it ceases to be distinguishable from the adjoining soil; but previous to this she pushes downwards the poppy lining till it completely covers the cell where her eggs are deposited (*i*)."

It is pity Reaumur did not give a more minute description of this ingenious little animal. He only informs his readers that it is a small bee, more hairy than *Apis mellifica*, with a body proportionably shorter, but nearly of the same colour. His figure conveys no adequate idea of it (*k*). In my frequent walks in the corn fields in this neighbourhood, I have never observed the poppy petals with portions taken from them in the manner he has described.

The English species of this family are extremely numerous, and I have not hitherto been able to discover any clue for a natural subdivision of it: the last forty species are distinguished by white abdominal fasciæ. To this family belong Panzer's *Andrena succincta, hirtipes, equestris, plumipes, Austriaca, lucida, nitida, derasa, vaga, aterrima, flavipes, bicolor* and *hæmorrhoidalis*; and his *Apis pilipes, vestita, farfarisequa, varians, dumetorum, atra, albilabris*, and *Sphegoides* (*l*).

APIS *. a. (*m*)

H.F.A. *Corpus* oblongiusculum, subpilosum; *Capite* trunco paulò latiori; *Linguâ* acutâ; *Tubo*

(*i*) Reaum. ubi supra, Mem. 5. p. 139—149. Tab. 13. fig. 1—11. (*k*) Ibid. fig. 5. (*l*) Fn. Germ. Init. n. 7. t. 10. n. 46. t. 15, 17. n. 46. t. 16. n. 53. t. 19. n. 56. t. 1, 2. n. 64. t. 17—20. n. 65. t. 19, 20. n. 7. t. 13. n. 55. t. 9. 14. n. 56. t. 12 —14. 23, 24. (*m*) Tab. 4. *Apis*. *. a.

subconico, apice tridentato dentibus æqualibus; *Fulcro* subtriangulari; *Laciniis* exterioribus nullis, interioribus lineari-lanceolatis, acutis; *Valvulis* apice lineari-lanceolato, incurvo, submembranaceo; *Palpis* exterioribus sexarticulatis, interioribus articulis quatuor, primo elongato; *Stemmatibus* in triangulo; *Naso* convexo; *Labio* ovali; *Maxillis* edentulis; *Antennis* approximatis, subclavatis, pedicello globoso, apice articulo primo longiori, conico; *Tibiis*, plantisque posticis, scopâ polliniferâ; *Unguiculis*, in omni sexu, bifidis; *Abdomine* ovali, ano fimbriato.

Maris *Caput* anticè truncatum. *Tibiæ*, plantæque posticæ, nudiusculæ. *Abdomen* lanceolatum.

Imago pollinifera.

The present family of *Apes* seems to form the connecting link between that genus and *Melitta*. Its general form and habit, its palpi, posterior legs, and anal fringe, evince its affinity to the fifth family of the latter; but its proboscis is that of a genuine *Apis*. It is distinguished from all the families, in both genera, by this singularity, that the antennæ of the males, as well as of the females, are subclavate. The number of species belonging to it, that I have hitherto seen, are but few, and I have only had an opportunity of inspecting the proboscis of a male: I had extracted that organ from the only female I ever possessed, but I unfortunately lost it before I could put it under the lens. This sex, in the woolly covering of its posterior legs, resembles *Melitta Swammerdamella*, but its maxillæ are without teeth, and in general habit it so entirely resembles the males, which are indubitably *Apes*, that I have little hesitation in placing it with them in this family: of the mode of nidification of the individuals that belong to it I know nothing, having taken only a single specimen upon an extensive heath.

*. b. (*n*)

H. F. A. *Corpus* oblongiusculum, subvillosum; *Capite* latiori quàm longo, trunco paulò angustiori, posticè obsoletè obtusangulo, supra depressiusculo; *Ore* crassiusculo; *Proboscide* glabrâ incurvâ; *Linguâ* planiusculâ; *Tubo* lineari, apice tridentato, dente intermedio majori; *Fulcro* subtriangulari; *Laciniis* exterioribus nullis, interioribus subsetaceis; *Valvulis* apice lineari-lanceolato, concavo, acuto, submembranaceo, lineâ longitudinali corneâ; *Palpis* exterioribus sexarticulatis articulo primo minutissimo, interioribus quadriarticulatis articulo primo elongato; *Stemmatibus* in triangulo; *Oculis* magnis, prominulis, fundo favoso; *Naso* convexo, distincto; *Labio* ovali, verticali; *Maxillis* edentulis; *Antennis* approximatis, filiformibus, rectis, articulis distinctis, scapo brevi, pedicello minuto; *Alis* corpore longioribus; *Squamulis* magnis, sæpius coloratis; *Scutello* tuberculis duobus plerumque munito; *Tibiis* posticis nudis; *Unguiculis* in omni sexu bifidis; *Abdomine* ovali,

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(*n*) Tab. 5. *. b. *Nomada*, Fab. Latr.

f. ovato-lanceolato, glaberrimo, variegato, segmento ultimo minuto et fere retracto, ano setoso.

Maris *Abdomen* lanceolatum, segmento ultimo exerto.

Imago in aggeribus viarum et floribus frequens obvia, non pollinilega, *Tenthredinum* tacito volatu notanda.

The gay colours which variegate the individuals of this family, in this respect so dissimilar to other *Apes*, and the want of hirsuties upon their abdomen, has occasioned them to be mistaken by some authors for *Vespæ.* That they do not belong to the genus *Vespa* their proboscis and elongate tongue sufficiently evince, and the same circumstances clearly prove that, after Fabricius, who has arranged them with his *Nomadæ,* we ought not to separate this family from *Apis.* A vast number of the species that compose it have, by many authors, been considered as nothing more than varieties of the *Apis ruficornis* of Linneus, who himself has led the way to this error by confounding, at least two distinct species, in the description he has given of that insect. It has happened here, as often in other instances, that the distinctive marks of a family have been mistaken for indications of a single species; and the red antennæ and ferruginous legs, which Linneus selected for the diagnostics of *Apis ruficornis,* are common to a great number of the individuals which this division includes: he has, however, considered

A. Fabriciana, *ferruginata*, and *cariosa*, all of which, I believe, belong to it, as distinct species. All the *Nomadæ* of Panzer, *N. scutellaris* and *crucigera* excepted, are to be referred here.

The history, economy, and mode of nidification of the insects of this family, as yet remains a secret: they frequent warm dry banks, out of the holes of which I have often seen them issue. They seem to be furnished with no means of carrying pollen. Their flight is silent, unattended by any hum. Their eyes, when they are first taken, exhibit a remarkable appearance, through the external reticulated covering a surface of hexagons is visible, which keeps shifting with the light. This appearance is also observable in *Apis Conica*, and some individuals of other families.

**. a. (*o*)

H. F. A. *Corpus* oblongum, villosum; *Capite* trunco paulò angustiori, rotundato, posticè obsoletè obtusangulo; *Ore* crasso; *Proboscide* subinvolutâ; *Tubo* lineari, apice tridentato; *Fulcro* elongato; *Laciniis* exterioribus corneis, articulo primo longiori, interioribus setaceis; *Valvulis* apice lanceolato-lineari, coriaceo, subplicato, linguam arctè amplexanti; *Palpis* exterioribus quinquearticulatis; interioribus biarticulatis; *Stemmatibus* in lineâ curvâ; *Oculis* prominulis; *Naso* convexo; *Labio* concavo-convexo, subquadrato, verticali;

(*o*) Tab. 5, 6. **. a. *Apis*, Fab.

Maxillis dente obsoleto, laterali; *Antennis* filiformibus, pedicello subgloboso, apice articulo primo longiori, conico; *Squamulis* magnis; Tibiis posticis scopâ nullâ polliniferâ; *Unguiculis* integris; *Pulvillo* emarginato; *Abdomine* ovato, acuto, segmento ultimo minuto.

Maris *Unguiculi* dente interiori submembranaceo. *Pulvillus* integer. Aliàs feminæ mas simillimus, et, nisi numero antennæ articulorum, et segmentorum abdominalium, vix distinguendus.

Imago non pollinifera.

Of this family I have as yet discovered only a single English species, viz. *Apis punctata* of Fabricius; I have observed several exotic insects in Sir Joseph Banks's Cabinet which belong to it, as does likewise the *Apis luctuosa* of Scopoli. These insects, although at first sight they appear very different, if closely examined will be found to be nearly related to the preceding family (*p*). Their antennæ are similar, as are likewise their maxillæ, and their posterior tibiæ are also without the polliniferous scopa.

Mr. James Trimmer has discovered both the sexes of *A. punctata* in the nidi of *A. retusa*. I have observed it follow that bee into its burrows in gravelly banks in the spring; I have also seen it enter holes in clay walls which might probably lead

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(*p*) An hujus generis? Lubenter ad *Nomadas* proscriberem. Panzer, de *Ape punctatâ*, n. 35. t. 23.

to nests of the same insect. Ray suspects it to be the male of a bee, now known by the name of *Apis pilipes*(q), but which is itself the male of *A. retusa*, Lin. and this probably from observing it enter the same nest. From all these circumstances, combined with the want of means to convey pollen, I cannot help entertaining some suspicion that this family contains insects, somewhat analogous to the *Cuculi* amongst the birds, which deposit their eggs in materials collected by more industrious animals for their own offspring. The analogy observable between the instincts of animals, which belong to different departments in Zoology, furnishes a field for curious inquiry hitherto little explored: I wish this hint may direct to that subject the attention of some gentleman who possesses the opportunity of contrasting the modes of life of the different classes of animals.

The sexes are less easy to be distinguished in this, than in any family with which I am acquainted: the additional joint in their antennæ and segment in their abdomen, are almost the only notes of difference.

**. b. (r)

H. F. A. *Corpus* lineari-lanceolatum, tomentoso-maculosum. *Capite* lato, rotundato, trunco paulo angustiori; *Ore* crassiusculo; *Proboscide* rectius-

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(q) Hist. Ins. p. 243. Species ultima.

(r) Tab. 6. **. b. *Nomada*, Fab.

culâ, glabrâ; *Tubo* lineari, apice tridentato dente intermedio majori; *Fulcro* elongato, subclavato; *Laciniis* exterioribus articulis æqualibus, interioribus brevibus, lineari-lanceolatis, acutis; *Valvulis* rectiusculis, apice lanceolato, obtuso; *Palpis* exterioribus minutissimis, exarticulatis; *Stemmatibus* in lineâ curvâ; *Oculis* magnis, prominulis; *Naso* convexo; *Labio* anticè curvo; *Maxillis* edentulis; *Antennis* filiformibus, scapo brevi, pedicello minutissimo; *Scutello* tuberculis duobus; *Tibiis* posticis scopâ nullâ; *Unguiculis* integris; *Abdomine* conico, acuto, ano dehiscenti.

Mas adhuc latet.

The only species belonging to this family with which I am acquainted at present, is the *Apis variegata* of Linneus, a gay insect which Fabricius has arranged with his *Nomadæ*. It is, however, quite distinct from them, being furnished with exterior laciniæ, which are wanting in them; its exterior palpi, likewise, consist only of a single joint and are very minute, so as not to be easily discoverable except under a lens. The spots which variegate its body are produced by decumbent hairs. Its conical abdomen and dehiscent anus connect it with the family to which *Apis conica* belongs, but it wants the inflected lip. Though the females in some summers are not rare flying about warm dry banks, I never yet met with a male. *Nomada crucigera* of Panzer appears to be merely a variety of this insect.

**. c. 1. *α*. (*s*)

H. F. A. *Corpus* lineari-lanceolatum subvillosum; *Capite* trunco angustiori, rotundato; *Proboscide* incurvâ; *Linguâ* planiusculâ; *Tubo* lineari, apice tridentato dente intermedio longiori; *Fulcro* elongato, subclavato; *Laciniis* exterioribus articulis subæqualibus, interioribus linearibus; *Valvulis* apice lanceolato-lineari, concavo, submembranaceo, lineâ longitudinali corneâ; *Palpis* omnibus biarticulatis, exterioribus acutis; *Facie* planiusculâ; *Stemmatibus* in triangulo; *Oculis* distantibus, pilosulis; *Labio* inflexo, elongato, concavo-convexo; *Maxillis* apice dentatis; *Antennis* distantibus, filiformibus, pedicello, apiceque articulo primo, subconicis; *Squamulis* magnis; *Scutello* obtusangulo; *Tibiis* posticis scopâ nullâ polliniferâ; *Unguiculis* integris, pulvillo obsoleto; *Abdomine* recto, acuto ſ. acuminato, basi retuso, ano dehiscenti, ventre glabro.

Maris *Unguiculi* apice bifidi. *Abdomen* segmento septimo obsoleto, ano spinoso.

Imago vix pollinifera.

The individuals of the family of the first section, of which this is a subdivision, are invariably distinguished by one remarkable feature, the labium, or lip, is elongate and inflected under the maxillæ, (which are remarkably large and strong with several teeth at their apex) so as to defend

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(*s*) Tab. 7. **. c. 1. *α*. *Apis*, Fab.

the lower fold of the proboscis from all injury, when the insect is employing them; a peculiarity, which, at least in the leaf cutter bees, did not escape the accurate eye of Reaumur. "Elles ont toutes un trompe," says he, "qui pour l'essentiel est composée comme celle des mouches à miel, mais qui à son origine est recouverte en dessus et par les côtés par une sorte d'étui écailleux, qui n' a point été accordé à la trompe de ces derniéres mouches. Cette piéce sert à empêcher que la trompe ne soit trop rudement frottée par les bords de la piéce que la coupeuse détache. Elle a peut-être encore d'autres usages: peut-être donne-t-elle plus de facilité aux dents pour couper juste; elle leur offre un appui, elle tient lieu d'une espece de petite table, d'une espece d'établi (*t*)." The males of this family are usually without the additional abdominal segment observable in those of others.

I have divided this family into two sections, the second distinguished from the other by a remarkable covering of hair for conveying pollen upon the venter of the female. The subdivision of the first section which we are now considering, is characterized by the conical and very acute abdomen of the female, with an anus not at all incurved, and by the singular spines which arm the anus of the males. These two sexes have been usually accounted distinct species, under the names of *Apis conica* and *quadridentata*; and all such insects as have

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(*t*) Reaum. tom. 6. Mem. 4. p. 122. Tab. 11. fig. 5—9. e.

have a conic acute abdomen have been referred by most entomologists to the one, and those that have similar anal spines to the other. This is the effect of fixing upon such characters to distinguish a species, as are rather the sexual distinctions of a family or subdivision. I have seen more than one good species amongst the exotic *Apes* of Mr. Drury's museum: and there is another in Sir Joseph Banks's, that came from New Holland, with violet coloured wings, which appears to me very distinct, though Fabricius has given it as variety β of *Apis conica*. *Apis tridentata*, and perhaps *A. barbara* of Linneus, belong to the present subdivision. *A. bidentata* of Panzer (*u*), is the genuine *A. conica* of the Linnean cabinet. The *A. conica* of Fabricius appears to be the other sex of that species which in this work I have named *A. inermis*. Upon the mode of nidification of the insects that belong to this subdivision, I have nothing to communicate, nor do I recollect a single author who has given any account of it; for that *Apis* in Reaumur (*x*), to which Linneus has too hastily referred as *Apis conica*, is the male of one of the leaf cutter bees, and belongs to the first subdivison of the second section of this family.

**. c. 1. β. (*y*)

H. F. A. *Corpus* lineare, cylindricum, subvillosum; *Capite* trunco angustiori, rotundato; *Pro-*

(*u*) Fn. Germ. Init. n. 59. t. 7.

(*x*) Tom. 6. Mem. 4. p. 121. Tab. 11. fig. 4.

(*y*) Tab. 7. **. c. 1. β.

boscide incurvâ; *Tubo* lineari, apice dentibus lateralibus obsoletis; *Fulcro* elongato, subclavato; *Laciniis* exterioribus articulis subæqualibus, interioribus brevibus, setaceis; *Valvulis* apice lineari-lanceolato, concavo, submembranaceo, lineâ intermediâ, longitudinali, corneâ; *Palpis* omnibus biarticulatis; *Stemmatibus* in triangulo; *Labio* elongato, inflexo, concavo-convexo; *Maxillis* apice dentatis; *Antennis* filiformibus, pedicello, apiceque articulo primo, subconicis; *Scutello*, subprominulo obtuso; *Tibiis* posticis scopâ nullâ polliniferâ; *Unguiculis* apice bifidis; *Abdomine* incurvo, ano obtuso, subdehiscenti, ventre glabro.

Mas adhuc latet.

The insects included in this subdivison, differ principally from those of the preceding in the form of their abdomen; which, instead of being conical and very acute, is cylindrical and obtuse: the claws also in the aculeate sex are bifid. Whether the anus of the males is armed with spines or not I cannot tell, having never taken an individual of that sex belonging to this subdivision; and of the other sex I have only met with three specimens. I had originally included the two species that I possess in the last subdivision of my second section of this family, mistaking them for male insects; but when I found that they were females, that their exterior palpi consisted only of two joints, and that the under side of their abdomen was without hair, I was under the necessity of forming a sub-a subdivision to include them. Upon their economy and history I can say nothing.

**. c. 2. α. (z)

H. F. A. *Corpus* oblongum, villosum; *Capite* trunci ferè latitudine, rotundato; *Linguâ* subinvolutâ; *Tubo* apice tridentato dentibus æqualibus; *Laciniis* exterioribus articulis æqualibus; interioribus brevibus, acutis; *Valvulis* apice lanceolato-lineari, concavo, incurvo, submembranaceo, lineâ longitudinali corneâ; *Palpis* omnibus biarticulatis; *Facie* planiusculâ; *Stemmatibus* in triangulo; *Labio* inflexo, elongato, concavo-convexo; *Maxillis* prominentibus, validissimis, apice dilatatis et dentatis; *Antennis* subfiliformibus, pedicello teretiusculo, apice articulo primo subconico; *Tibiis* posticis scopâ, haud densâ, polliniferâ; *Plantis* dilatatis; *Unguiculis* latere interiori denticulo armatis. *Abdomine* horizontali vel ascendenti, basi retuso, tergo planiusculo, ventre lanâ densâ polliniferâ vestito.

Maris *Plantæ* angustiores. *Unguiculi* apice bifidi. *Anus* obtusus, incurvus, interdum emarginatus, segmento ultimo minuto, inflexo.

The second section of this family includes all those insects the under side of whose abdomen, in the aculeates, is clothed with a coat of hairs, usually very thick, and set like those of a brush, involved in which they convey the pollen to their cells. The individuals of its first subdivision are distinguished by biarticulate exterior and interior palpi, and a horizontal abdomen, flattish above, or not so convex as in the other subdivisions, which the insect will sometimes elevate so as to form an obtuse angle with thorax. The entertaining history of the insects that form this subdivision has attracted the attention of many naturalists: so early as the year 1670 it was noticed by Ray, Dr. M. Lister, Willughby, and Sir Edward King (*a*). The Divine Wisdom has instructed these insects to form very wonderful cells for their young of singular materials, the leaves of trees, especially the rose, from which circumstance they have been known by the name of *leaf cutter bees*. (*coupeuses de feuilles*. Reaum). Reaumur has given a very particular account of their history, preceded by a humorous story of the alarm spread by the discovery of their nidi in a country village in France. This story is so admirably abridged in a paper, entitled, *miracula insectorum* in the third volume of the *Amœnitates Academicæ*, that I think my readers will not be displeased at my inserting it here.

(z) Tab. 8. *Andrena, Apis,* Fab. *Coupeuses de feuilles.* Reaum.

" De hortulano historiam Nob. Reaumur, Galliæ decus, adfert, qui hortum fodiens plurimos invenit centunculos adeò mirificè convolutos, ut vi naturale extitisse nunquam sibi imaginari posset,

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(*a*) Ray's Letters, p. 72—74. Histor. Insect. p. 245. Philosoph. Transact. abridged, by Lowthorp, vol. 2. chap. 6. §. 17. p. 1—4.

potiùs credens sagas vel aniculas quasdam veneficas veneficium hoc, ad prædium incolasve prædii lædendum, defodisse. Nudis manibus eos minimè tangere audebat, sed manicis munitus vicinis suis ostensurus colligit, qui non nisi magias esse horribiles cum eo concinnebant. Anxius itaque sacerdotem adit, ei affatus lamias vel magas in ecclesiâ ejus reperiri, quæ insidias prædio pararent. Sacerdos timore perculsus, se de ejusmodi nodis magicis legisse, eos verò nunquam antea vidisse, confitebatur; signoque crucis ter quaterque posito, hortulanum ad dominum suum, Parisiis degentem, proficisci desperatus suadet, ut hosce repræsentando, ab omni culpâ venturi mali liberatus esset. Parisios ille petens, pallido colore et sono rauco, quæ invenerat patrono indicat, qui horum ignarus chirurgum suum consulit; sed nec is ulteriore cognitione instructus erat; conveniunt ea propter ut sententiam peterunt experientissimi physici Dni. Nollet, qui advocatus horum visu lætebatur, et similes adferens, centunculos illos dicit esse domicilia insectorum, unumque eorum aperire incipit, cum capilli hortulani præ timore erigebantur, metuendo aliquid mali eis certo contingere. Absque periculo autem D. Nollet embryonem apis, quæ de foliis roseis nidum condiderat, detrahit; et sic tota magia in naturale domicilium innocentis apis, commutata fuit (*b*)."

It has often happened in natural history, and more particularly in entomology, that characters

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(*b*) P. 319—20.

and modes of life have been regarded as peculiar to a single species, which, in fact, are the prominent features of a family, or a subdivision. This, as I have just had occasion to observe, has happened to those *Apes*, whose acculeates are distinguished by a conical and very acute abdomen: the same error has taken place in the present subdivision, for all those *Apes* which construct centunculi, or cases made of the leaves of trees, to receive their eggs, have been looked upon by Linneus, and most writers, as varieties of one species, which that great naturalist has named *A. centuncularis*, and denoted it chiefly by the orange coloured hairs which cover the under side of its abdomen, a character which it possesses in common with a large number of species in this family. A similar mode of nidification may be, and indeed very often is, the characteristic of a family or genus rather than a species: thus, the cells of the different species of the *Bombinatrices* are composed of similar materials and resemble each other in form; and the various genuine species of the genus *Vespa* construct cells, for the most part, of the same figure, and employ the same kind of materials(*c*); the mode of nidification, therefore, should never be assumed as characteristic of a species, but after the most mature consideration, and the closest and most attentive investigation of its history, economy, &c. for it generally happens that those insects which agree together in

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(*c*) Reaumur, tom. 6. Mem. 6, 7. Tab. 14—25.

habit, and belong to the same *natural* divisions or subdivisions of a genus, are connected likewise by their mode of life. As to characters, before any particular one is selected for the definition of a species, inquiry should first be made whether it may not be a sexual distinction common to many individuals. But the science of entomology is far behind botany; in innumerable instances we are at a loss to discover and discriminate the sexes. The present work, I flatter myself, may contribute to remove some of the difficulties which stand in the way of our attaining this knowledge. The sexes of the two genera, to which these pages are devoted, may now be detected with ease; and, perhaps, the discovery of a similar circumstance may enable some future entomologist to point out the sexes in all the classes of insects. If some of the largest and most common individuals in each were dissected, and examined with sufficient attention, probably this desideratum might soon be attained. But to return from this digression.

The aculeates in this family furnish no very striking and prominent features for specific definitions, they are so extremely similar to each other, that it is not wonderful that they have been so much confounded, but this difficulty is, in a great degree, removed by the males, which will supply the describer with some very strong characters. Thus, the male of the genuine *Apis centuncularis*, which makes its centunculi of rose leaves, has an entire anus, while that of the species, which perforates the oak or elm, is emarginate (*d*). Several are distinguished by the remarkable form of the fore leg, especially the palm, which is dilated and singularly ciliated on one side (*e*); the males that exhibit this peculiarity, have been all confounded under the name of *A. lagopoda*. This conformation, however, of the fore leg is common to several distinct species, which are separated from each other by very striking differences. The genuine *A. lagopoda* of the Linnean cabinet is larger than any other that I have seen, with filiform antennæ, and posterior tibiæ very large and incrassate. A small one that stands by this, as a variety, in the same cabinet, seems distinct; it is black, less hairy, and its tibiæ are proportionably smaller, it may be the *A. lagopoda* of Panzer (*f*). The male of the willow bee, so well known to English naturalists, which is the only male, of this description, that I have known taken in England, is distinguished from both these by its capitate antennæ, like those of a *Papilio* (*g*). The male of that species, the centunculi of which so alarmed the poor gardener and the priest, as described by Reaumur, has the same kind of fore legs, and is also remarkable for a quadridentate anus (*h*). This is the insect referred to by Linneus as *Apis conica*. The male

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(*d*) Tab. 8. fig. 25, 26.

(*e*) Ibid. fig. 28. *g*.

(*f*) Fn. Insect. Germ. n. 55. t. 7.

(*g*) Tab. 8. fig. 8. *a*.

(*h*) Tom. 6. Mem. 4. Tab. 11. fig. 13—16.

of *Andrena bidentata* of Fabricius, is another very distinct species of this kind, which I have seen in Sir J. Banks's cabinet. Of this, that author observes, "*Nidum in muris e foliis arborum convolutis struit* (*i*);" from which circumstance, it is evident, that its female is one of the *centunculares*. I have another exotic male, given me by Mr. Sowerby, which comes very near this, if it be not the same insect.

Reaumur informs us, that he was acquainted with five species which construct their nests in this way, and he suspects that there are many more (*k*). All those, to which he had attended, lodged their centunculi under ground (*l*). Geoffroy represents his *A. centuncularis* as making its nests in the trunks of decaying trees (*m*). This is the case with three at least of our English species; two of them, I believe, nidificate under ground (*n*). These reasons, I hope, will justify me sufficiently for having made so many species out of what before had been accounted only one.

I shall now abridge Reaumur's interesting account of the history of these most ingenious insects, and add to this what I have been able to collect from other quarters.

"The nests they construct," our author informs us, "are cylindrical, sometimes of the length of

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(*i*) Ent. Syst. Em. n. 27.

(*k*) Reaum. ibid. p. 119-20.

(*l*) Ibid. p. 123.

(*m*) Hist. Ins. tom. 2. p. 410. n. 5.

(*n*) Viz. *Apis circumcincta* and *xanthomelana* of this work.

six inches, and composed entirely of the leaves of the rose and other trees. They consist usually of six or seven cells; each cell is shaped like a thimble, the convex end of the second fitting closely into the open end of the first, the third into the second, and so on with respect to the rest. Although these cells are honey tight, which is sometimes found in them in a liquid state, yet the portions of leaf of which they are made are not glued together, neither is there any other art used to fasten them, than what appears in the nicety with which they are adjusted to each other. The interior surface of each cell consists of three pieces of leaf of equal size, narrow at one end, but growing gradually wider towards the other, where the width equals half the length. One side of each of these pieces is the serrate margin of the leaf from which it was taken. In forming the cell, the pieces of leaf are made to lap one over the other, so that the serrate side is kept on the outside, and that which has been cut, within: thus a tube is first formed, and in this way it is coated with three or four layers (*o*), the exterior covering being made of larger pieces than the interior. In coating, the provident little animal is careful to lay the middl of each piece of leaf over the margins of those the form the first tube; thus the junctions are co ed and strengthened. At the closed end, or rrow extremity of the cell, the leaves have a b d given

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(*o*) Sometimes there are more, K

them so as to form a convex termination: when a cell is formed in this manner, her next care is to fill it with honey and pollen, which make a rose-coloured paste or conserve (*p*): when it is filled to within about half a line of the orifice, she deposits her egg in it, and closes it with three pieces of leaf (*q*), which are so accurately circular, that a pair of compasses could not define their margin with more truth: these coincide exactly with the walls of the cylindrical cell, and are retained in their situation by no gluten, but merely by the nicety of their adaptation. After this covering is fitted in, there remains still a concavity which receives the convex end of the succeeding cell. In this manner the patient and indefatigable little animal proceeds, till she has completed her cylinder of six or seven cells. This cylinder is coated externally by other pieces of leaf of larger dimensions than those used in making the cells, and of a different form, for they are nearly oval; those at the ends are bent inwards, to cover each extremity. These nests are usually made in fistular passages, which these indefatigable creatures bore under ground, in a horizontal direction: their diameter is exactly that of the cylinder, to which indeed they give its form, and their bend to the pieces

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() They usually collect their honey and pollen from the thistles and *Onopordum*, the pollen of which is rose-coloured, K.

(*q*) I have taken nine of these covers from the mouth of a cell of *A. niscca*, K.

that compose it. If, by any accident, their labour is interrupted or their edifice deranged, it is astonishing with what persevering patience they set themselves to put all things again to rights.

"The mode in which they cut the pieces of leaf, of which their nests are made, deserves particular notice. Nothing can be more expeditious; they are not longer about it than we should be with a pair of scissars. When one of these bees selects a rose bush with this view, she does not immediately alight upon it, but keeps hovering over, and flying round it, for some moments, as if reconnoitring the ground to discover the spot best adapted to her purpose. When she has chosen a leaf, she alights upon it, sometimes taking her station on its upper surface, sometimes underneath it, and at others upon its edge, so that the margin passes between her legs. Her first attack, which is generally made the moment she alights, is usually near the footstalk, her head being turned towards the apex. Now and then, however, she places herself near the apex, facing the footstalk. As soon as she has made a beginning, she continues cutting, with her strong maxillæ, without intermission, till she has finished her work. As she proceeds, she keeps the margin of the detached part between her legs, those of one side being above and the other below it, so that the section keeps giving way to her, and does not interrupt her progress. She makes her incision in a curve line, approaching the rachis at first, but when she has reached a certain point, she keeps receding from it towards the margin, still cutting in a curve. When she has nearly detached the portion she has been employed upon from the leaf, she balances her little wings for flight, lest its weight should carry her to the ground, and the very moment it parts from its parent stock, she flies off with it in triumph; the detached portion remaining bent between her legs, and being perpendicular to her body. She pursues the same mode whatever be the form or size of the piece necessary for her purpose.

"The larvæ of these bees do not differ from those of the hive bee; when arrived at their full size, they spin a cocoon of silk, thick and solid, which they attach to the sides of their cell. The outside of this cocoon is covered with coarse brown silk, but its interior is lined with very fine threads of silk of a whitish colour and close texture, which shine like satin. These larvæ are exposed to the attacks of some *Dipterous* insect, which makes its way into the cells and there deposits its eggs." Thus far from this illustrious author (*r*).

I cannot help suspecting that, in this account, he has fallen into one error, with respect to the little animals mode of building her cylindrical nest, for he seems to think that the cells are first made, and then their exterior covering: but if we con-

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(*r*) Reaum. tom. 6. Mem. 4. p. 97—124.

sider all circumstances, that the nest takes its form, and the leaves that compose it their bend, from the tubular passage in which it is built; it seems not possible that the interior part should be first formed, for in this case the tube, composed of the three first pieces of leaf, must be smaller than the mould in which it is made, and then how could these retain the bend the insect gave them, and without any gluten adhere together before they grew stiff? As soon as the little animal quitted them, they would lose the form she had given them, and fly to the sides of the passage. Besides, supposing this not to take place, how could she get between the cells, and the sides of the passage, to lay on the exterior coat of the cylinder? It is most natural to suppose that this is first formed, taking its figure from the pipe in which it is built, and the interior part last.

I shall next insert an extract from a letter of my venerable friend, the Rev. George Ashby, of Barrow in Suffolk, well known as a learned antiquarian, addressed to a gentleman who had sent him a specimen of the nest of the *Willow Bee.*

"The curious specimen you obliged me with yesterday is the workmanship of a small taper bee, velvetty or hairy all over, black on the back, and yellow or tawney beneath. Linneus calls it *centuncularis,* from the patch-work case or coverlit which it makes to lodge its eggs, and future grubs or maggots in: it seems there are two sorts of them; at least as to disposition and economy: that best known bores its fistular passage under ground, and there constructs its cases.

"The cases look like pellets from pop-guns, or small rockets made on a mandrill in an hollow tubular mould, $\frac{7}{8}$ of an inch long, or near inch; more than inch round. Each end is covered with a circular piece of leaf of the proper size, and is alternately convex and concave; and so inosculates closely that the junction is hardly preceptible. I started a difficulty yesterday, how the first laid egg, after being a maggot, and a chrysalis, and last of all a bee, got out through all the superincumbent houses, whose inhabitants were not yet ready to quit them. But nature is never to be caught at fault, and the lowest and first born passes out through the bottom of its own (lowest) cell, and so escapes without disturbing any of the rest, who are not yet ready to emigrate: when they are, they do the same successively, and pass on through the empty cases of their predecessors, till they reach day-light; and a long journey the last hatched must have: and if only the mother bee makes the original pipe, considering the quantity you mentioned, how vast is such a little creature's labour.

"After boreing the hole, the bee who works in the center, and consequently may be considered as the mandril, or rather as the paperer, lines the inside of the wooden pipe with rose leaves; and every now and then, at stated distances, finishes her work with a covering, and so proceeds."

I shall next transcribe the account given by Mr. Willughby of the nidification of the same bee from Ray's *Historia Insectorum* (*s*).

"Thecas cylindraceas e segmentis foliorum rosaceorum artificiosè convolutis et agglutinatis efformant hæ Apes: Anglicè *Cartrages* dici possunt, ab exactâ similitudine quam habent cum papyraceis involucris pulvere pyrio repletis pro bombardis majoribus. Figurâ sunt cylindraceâ, basi rotundiusculâ et parum convexâ, summitate e contra excavatâ, longæ $\frac{5}{8}$, diametro $\frac{3}{8}$.

"In salicum truncis jam mollibus et putrescentibus varios effodiunt cuniculos cylindraceos exactè æquales capsulis jam descriptis. Foramina isthæc vel sursum, vel deorsum tendunt, secundum pectines scilicet seu fibras ligni, nunquam transversim. Multa horum foraminum communem habent introitum, per quem Apis ingreditur et egrèditur cùm cuniculos dentibus erodit. In cunuculi fundo infima, (vel quando cuniculi sursum tendunt) suprema capsula locatur, et exactissimè spatium implet, fundo seu convexâ extremitate capsulæ fundo cuniculi adjacente. Hujus (capsulæ) summitati concavæ alterius convexus fundus arctè applicatur, et sic deinceps, ita ut 5, 6, vel 7, in uno cuniculo inveniantur capsulæ, aliæ aliis superimpositæ. Capsulæ implentur crasso, rubenti, acido et

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(*s*) P. 245.

grave-olente liquore, syrupi violacei aut conservæ rosarum rubrarum ſerè colore, cui innatat nympha ab ovo quod ibi deponit Apis orta, quæ usque ad mutationem liquore illo vescitur, jamque mutatura thecâ se includit. Nymphæ $\frac{3}{4}$tas unciæ longæ sunt, plusquam $\frac{1}{4}$tam latæ, rugosæ, colore albo, forcipibus nigricantibus, capitibus fere eruciformibus. Infimæ apes semper seniores sunt et majores; foramini seu exitui proximæ minores et juniores, sed omnes simul efformantur, et calor irritat ad exitum foramini proximas. Per integrum ferè annum in capsulis latent."

Can we consider this curious history without adoring that DIVINE WISDOM which teaches these diminutive creatures to provide in so wonderful a manner for the security and sustenance of their young? Who is it that instructs them to bore a fistular passage either under ground or in the trunk of a tree for the reception of their nests? What rule do they take with them to the shrub from which they borrow their materials to assist them in meting out their work, by which they cut some pieces into portions of an ellipse, others into ovals, others into accurate circles, and to suit the dimensions of the several pieces of each figure so exactly to each other? Where is the architect who can carry impressed upon the tablet of his memory the entire idea of the edifice he means to erect, and without rule, square, plumb-line, or compass, can cut out all his materials in their exact dimensions, without making a single mistake or a single false stroke? And yet this is what these little animals invariably do, and thus teach us how much more wonderful and certain instinct is, than all the efforts of our boasted reason, which after many painful processes interrupted by numerous errors and failures, and by a long train of deductions, cannot arrive at that expertness and certainty, which these creatures manifest spontaneously, working at all times with unerring precision. What is this instinct but the teaching of the ALMIGHTY, the manifestation of his ETERNAL WISDOM infinitely diversified (*t*), sustaining, directing, impelling all things, and making all things work together for the good of the whole? Which, like its great emblem and instrument the light, acts every where and upon all; and while it guides the planets in their courses, directs the minutest animalcule to do those things that are necessary to its preservation and the continuation of its kind. "Oh the depth of the riches both of the wisdom and knowledge of GOD! How unsearchable are his judgments and his ways past finding out! Of him and through him, and to him are all things; to whom be glory for ever. Amen (*u*)."

** *. c. 2. β. (*x*)

H. F. A. *Corpus* oblongum, villosum, sæpius flavo variegatum; *Capite* trunco paulo angustiori,

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(*t*) Η πολυποικιλος σοφια. Ephes. iii. 10.

(*u*) Rom. xi. 33, 36,

(*x*) Tab. 9. **. c. 2. β. *Apis*, Fab.

rotundato; *Linguâ* subinvolutâ; *Tubo* dentibus lateralibus obsoletis; *Fulcro* elongato, subclavato; *Laciniis* exterioribus articulis subæqualibus, interioribus lineari-lanceolatis, acutis; *Valvulis* apice lanceolato-lineari, concavo, incurvo, submembranaceo, lineâ longitudinali corneâ; *Palpis* exterioribus exarticulatis, pilosis; *Stemmatibus* in triangulo; *Naso* convexo, distincto; *Labio* elongato, inflexo, concavo-convexo; *Maxillis* forcipatis, validissimis, apice dilatatis et multidentatis; *Antennis* subclavatis, pedicello, apiceque articulo primo, subconicis; *Plantis* dilatatis; *Unguiculis* apice bifidis; pulvillo minutissimo; *Abdomine* subgloboso, convexo, basi subretuso, incurvo, ventre lanâ polliniferâ vestito.

Maris *Maxillæ* apice tridentatæ. *Antennæ* filiformes. *Anus* inflexus, spinosus. *Plantæ* angustiores.

Imago pollinifera.

The insects of this subdivision, of which at present I know only one English species, viz. *Apis manicata*, Lin. are distinguished from those of the last, not only by exarticulate exterior palpi, but likewise by the form of their abdomen, which is convex and rather globose with an incurved anus, in the male often inflected and armed with long spines (*y*). They are also adorned with gayer colouring than the individuals of the other sections of this family, the abdomen being usually variegated with yellow spots.

(*y*) Tab. 9. **. c. 2. β. fig. 11.

Linneus observes upon this bee "*In arboribus cavis nidos construit*;" but he takes no notice of the materials of which the nidi were made: this deficiency has been supplied by Mr. James Trimmer and Sir Thomas Cullum. The former of these gentlemen sometime since informed me, that having frequent opportunities of watching the motions of *Apis manicata*, and finding that it constantly attended *Stachys Germanica*, *Agrostemma coronaria*, and other woolly leaved plants which grew in his garden; he was curious to know the reason of this preference. It was not long before his curiosity was gratified, and he discovered that it was the wool which covers the surface of the leaves of these plants, that was the attraction; for he observed the little animal, with her strong maxillæ, scraping it off with great industry and perseverance; and while these were thus employed, rolling it up, with her fore legs, into a little ball; making all the time a considerable hum. The use to which she applied the material thus collected Mr. Trimmer could never discover, we only conjectured that she employed it in the construction of her nest. Our conjecture is almost turned into certainty, by the following account, given, by my ingenious friend Sir Thomas Cullum, to Mr. Marsham, of a nest which he found made of similar materials. He thus expresses himself concerning it in a letter to that gentleman. "I observed in a lock to one of my garden gates, that the key did not turn round easily, and upon looking into the key hole I saw something white. I had the lock taken off, and it was completely full of a downy substance, containing the pupa of some bee, I conclude. Upon examining the downy substance, I am certain it is the fine pappus, or down, from the *Anemone sylvestris,* of which I had two plants in my garden. I have preserved the whole as I found it, but the bee has not yet made its appearance in its perfect state. I shall watch their progress, and send them to you, or to Mr. Kirby." This letter is dated October 10, 1800. Sir Thomas has since had the goodness to send me the nidus, the pupæ are still quiescent, (April 2, 1801) and probably will not be disclosed till after midsummer. Upon comparing it with the anecdote, which I have just related of *A. manicata,* I cannot help being of opinion that it is the nidus of that *Apis.* It is with some hesitation that I venture to differ from so accurate an observer as Sir Thomas Cullum, but it appears evident to me that the wool which envelopes the nest and the cells, is scraped from the leaves of one of the plants mentioned above. I gathered some leaves of *Agrostemma coronaria,* and with my pen-knife shaved off some of its down, and upon comparing it with that used in the nest under a magnifier, I found that they were exactly the same. This, in conjunction with Mr. Trimmer's account, persuades me that the material employed in this instance is not the pappus of *Anemone sylvestris,* which is of a more silky texture.

There were several cells, or cases, included in the lock, unconnected with each other, except by the wool which was their common covering. These cases were of an oval form (z), and consisted of an exterior coat of wool; under this was a membranaceous cell, of a pale colour, which was covered with a number of small vermiform masses of a brown substance, seemingly made of pollen and honey, in shape and size much resembling *Sphæria canaliculata,* and like that fungus distinguished by a longitudinal furrow slightly impressed (*a*). These were laid, without any regular order, over the cell; and by means of them the wool which formed its exterior coat was made to adhere. It is remarkable that this bee should employ those materials to cover its cells, which others use only as food for their larvæ. At the summit of this membranaceous case is a small chimney with an orifice (*b*), and within it contains another cell, which is rather coriaceous, strong, and of a brown colour, in the inside shining very much as if covered with tinfoil (*c*). This may be the folliculus or coccoon made by the larva, previous to its assuming the pupa. I opened one of these in the autumn, and another in the spring. In both the animal was still in its larva state, but had no food remaining in

(z) Tab. 14. n. 11. fig. 13.

(*a*) Ibid. fig. 14. *aa.* fig. 17.

(*b*) Ibid. fig. 15, 16.

(*c*) Ibid. fig. 16.

its cell. In that opened in the spring it appeared to be dead. I imagine, when Sir Thomas Cullum first took them, that they were just ready for their first change; but that the alteration occasioned by removing the nest from the situation the parent insect had chosen for it, was fatal to some, if not all, of its inhabitants. The larva does not differ materially from those of other Apes (*d*). Amongst the wool, which, I suppose, formed the general envelope of the nest, were masses of honey, or a sweet pollen paste.

This bee is very common in gardens in towns, or in the neighbourhood of towns. I never met with it in my own garden, or in the country.

**. c. 2. γ. (*e*)

H. F. A. *Corpus* elongato-cylindricum, subpilosum; *Capite* trunco paulò latiori, subgloboso; *Linguâ* tenui; *Tubo* apice tridentato, dente intermedio majori; *Fulcro* subtriangulari; *Laciniis* exterioribus articulo primo brevessimo; *Valvulis* apice lanceolato-lineari, concavo, submembranaceo, lineâ longitudinali corneâ; *Palpis* exterioribus biarticulatis, interioribus exarticulatis; *Stemmatibus* in triangulo; *Naso* convexo; *Labio* elongato, inflexo, concavo-convexo; *Maxillis* basi latioribus, apice bidentatis; *Antennis* subclavatis, pedicello magno, subovato; *Abdomine* sublineari, anum versus paulò latiori; *Ventre* lanâ polliniferâ subhirsuto.

(*d*) Tab. 14. n. 11. fig. 18.

(*e*) Tab. 9. **. c. 2. γ. *Hylæus*, Fab.

Maris *Antennæ* filiformes. *Ano* incurvo, sæpius dentato. *Ventre* anum versus cavitate notando.

The third subdivision of this section, is distinguished by a peculiarity which exists in no other *Hymenopterous* insects that I have examined; the interior palpi of the species that belong to it consist only of a single joint (*f*). Their body is very long, slender, and cylindrical; the venter of the males, near the anus, is remarkable for a singular cavity, usually covered with down of a pale colour and resembling satin, to answer which, at its base, there is either a kind of horn, or a protuberance (*g*). These insects, when asleep, roll themselves up something like *Oniscus Armadillo*, the horn or protuberance fitting into the anal cavity: they nidificate in posts and rails. The males usually take their luxurious repose in the lap of a flower: that sex of *A. Campanularum*, selects for this purpose the bells of the different species of *Campanula*, which the female also frequents for the sake of the honey. *Hylæus florisomnis, maxillosus*, and *truncorum* (*h*), figured by Panzer, belong to this subdivision.

**. c. 2. δ. (*i*)

H. F. A. *Corpus* cylindricum, villosum, sæpe hirsutum; *Capite* trunci ferè latitudine, subglo-

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(*f*) Tab. 9. γ. fig. 5. *b*. (*g*) Ibid. fig. 11. 13. *a*.

(*h*) Fn. Germ. Init. n. 46. t. 13. n. 53. t. 17. n. 64. t. 15.

(*i*) Tab. 10. **. c. 2. δ. *Andrena, Apis*, Fab. *Abeilles maçonnes*, Reaum.

boso; *Linguâ* longissimâ, subinvolutâ; *Tubo* apice tridentato, dentibus lateralibus interdum obsoletis; *Fulcro* elongato; *Laciniis* exterioribus articulo ultimo longiori, interioribus lanceolatis, acuminatis; *Valvulis* incurvis, apice lanceolato-lineari, membranaceo, lineâ longitudinali corneâ; *Palpis* exterioribus quádriarticulatis, interioribus biarticulatis; *Stemmatibus* in lineâ curvâ; *Naso* convexo; *Labio* elongato, inflexo, concavo-convexo; *Maxillis* ferè in angulum protensis; *Antennis* plerisque subclavatis, pedicello, apiceque articulo primo, subconicis; *Unguiculis* integris; *Abdomine* declivi, supra convexo, ano sæpius incurvo; *Ventre* lanâ polliniferâ hirsuto.

Maris *Antennæ* pedicello subgloboso. *Unguiculi* apice bifidi. *Abdomen* segmento septimo obsoleto. *Anus* sæpe emarginatus, aut dentatus.

This last subdivision of the second section of this family, contains a greater number of species than the preceding ones: they are distinguished by a cylindrical, but not elongate, body; and their exterior palpi, in which circumstance they differ from all the other subdivisions, consist of four joints. Their abdomen is very convex, and that of the males furnished with no ventral concavity. The *Abeilles Maçonnes* of Reaumur appear to me to belong to this subdivision; I shall, therefore, insert in this place an abridgment of his interesting account of the mode of nidification of those insects.

He informs us, that the nests of these little bees are constructed of a kind of cement or mortar, in the following manner. “The female (for the males, like the drones of the hive bee, do no work, and these insects have only two sexes) undertakes the whole labour of the building, and is, at the same time, both architect and mason. Her first step is to fix upon an angle, sheltered by any projection, on the south side of a stone wall. Sometimes she contents herself with a more exposed part of the surface, where the stone happens to be uneven and fit for her purpose. Having chosen a spot proper to receive the foundations of the future mansion of her offspring, her next care is to provide materials. As her house is to be built entirely of a kind of mortar, the basis of which, as it is of ours, must be sand; she is very curious in her choice of it, selecting it, grain by grain, from such as contains some mixture of earth. To shorten her labour, before she transports it for use, by means of a kind of saliva which is very viscid, she glues as many grains as she can carry into a little mass, about the size of small shot. Taking this up with her maxillæ, she conveys it to the spot she has fixed upon for the scite of her castle. A circular plane, composed of many of these little masses, forms the basis on which it is to be erected; it contains from three to eight cells (*k*), which are similar to each other in their form, and equal

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(*k*) Geoffroy says twelve or fifteen

in dimensions. Each cell is about an inch in length, and six lines in diameter; and, before its orifice is closed, in form resembles a thimble. When its walls are raised to a sufficient height, our little mason lays up in it a store of pollen seasoned with honey, for the sustenance of its future inhabitant; sometimes the proportion of honey is so great, that this provision is entirely liquid. This business settled, she deposits her egg, finishes and covers in the cell, and then proceeds to the erection of a second, which she furnishes and finishes in the same manner; and so on with respect to the whole nest. These cells are not placed in a line, or any regular order: some are parallel with the wall, others are perpendicular to it, and others are inclined to it at different angles: this occasions many empty spaces between the cells, which this laborious architect fills up with the same kind of cement, and then bestows upon the whole group a common covering, made with coarser grains of sand; so that at length the nest becomes a mass of mortar, very hard and not easily penetrated, even by the blade of a knife. In form, it is more or less oblong; its colour depends upon the colour of the sand employed in its construction, and is different in different countries. These bees sometimes repair old nests, for the possession of which they have often very desperate combats.

" When the larva of this bee is arrived at its full size, it spins itself a cocoon of silk, in which it reposes during its intermediate state.

" Strongly fortified as these animals appear to be in their little castles, they are exposed to the attacks of a peculiar *Ichneumon*. *Attelabus apiarius* likewise contrives to deposit its eggs in their cells, and its larva devours their inhabitants (*l*)."

Other bees, that belong to this subdivision, use only fine earth (which they form into a kind of mortar with gluten) in the construction of their nests, which are usually placed in situations sheltered from wet. *Apis bicornis* selects the hollows of large stones for this purpose (*m*). Others, again, make their cells of earth in holes in wood. *Apis cærulescens*, of which *Apis ænea* is the male, constructs its nests, as we learn from De Geer (*n*), of argillaceous earth mixed with chalk, upon stone walls. I have reason to think that it also nidificates in chalk pits.

The males, in this subdivision, often differ very widely from the other sex, so as to have been described, in more than one instance, as distinct species, as I shall have occasion to shew more at large hereafter. The female of Reaumur's *Abeille maçonne* is black, while the male is red (*o*).

(*l*) Reaum. tom. 6. Mem. 3. p. 57—88. (*m*) Ibid. p. 86. (*n*) Tom, 2. p. 2. p. 751—54. Tab. 32. fig. 1—5. (*o*) Reaum. ubi supra, p. 60, 61.

The following insects, figured in Panzer's work, appear to belong to this subdivision: viz. *Apis cornigera, adunca, rufa, fusca, aterrima, fuliginosa, fulviventris, ventralis, byssina, globosa, fronticornis, aurulenta* (*p*), and *Andrena ænea* and *cærulescens* (*q*).

**. d. 1. (*r*)

H. F. A. *Corpus* oblongum, villosum; *Capite* trunco paulò angustiori, subtriangulari, ore crassiusculo; *Proboscide* apice subulato-conicâ, rectiusculâ; *Linguâ* involutâ; *Tubo* apice tridentato; *Fulcro* elongato; *Laciniis* exterioribus articulo primo longiori, interioribus exteriorum longitudine, involutis, intus ciliatis; *Valvulis* apice recto, lanceolato-lineari, acuminato, subplicato, coriaceo; *Palpis* exterioribus sexarticulatis, interioribus biarticulatis; *Stemmatibus* in lineâ curvâ; *Oculis* prominulis; *Naso* convexo, distincto; *Labio* anticè emarginato; *Maxillis* subedentulis; *Antennis* subclavatis, pedicello subgloboso, apice articulo primo elongato, basi attenuato; *Tibiis* posticis scopâ polliniferâ; *Plantis* posticis dilatatis, hirsutis; *Digitis* infra apicem plantæ insertis; *Unguiculis* apice bifidis; *Abdomine* oblongo, basi subretuso, segmento ultimo minuto.

(*p*) Fn. Ins. Germ. Init. n. 55. t. 15. n. 56. t. 5, 10, 11, 15, 16, 18, 20, 21, 22. n. 63. t. 20, 22.

(*q*) Ibid. n. 56. t. 3. n. 65. t. 18.

(*r*) Tab. 10. **. d. 1. *Eucera*, Scop. Fab. Latr.

Maris *Antennæ* corporis longitudine, articulis arcuatis, ex hexagonis innumeris constantibus, apice articulo primo minuto. *Plantæ* posticæ tenuiores.

The individuals of the family of which this is a section, are distinguished from the *Bombinatrices*, to which they approach, and with which many of them have hitherto been confounded, by the form of the inflected part of their proboscis; the tops of the valvules having no bend, and conniving into a figure more or less conical, somewhat resembling the beak of a bird (*s*); by their exterior palpi of six joints (*t*); by their elongate interior laciniæ (*u*); by the shape of their maxillæ, which are not dilated at their apex (*x*); by the want of the corbicula and auricle, which distinguish the posterior tibiæ and plantæ of the aculeate sex of the *Bombinatrices*; and by several other peculiarities which will appear upon a comparison of their respective characters.

The species which I have arranged under the first section of this family, belong to the genus *Eucera* of Scopoli and Fabricius, so named from the long antennæ for which the males are remarkable. This circumstance, in conjunction with the interior laciniæ, which are as long as the exterior, and have involute summits, forms the distinctive

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(*s*) Tab. 11. **. d. 2. *a*. fig. 3. *d*. (*t*) Ibid. fig. 2. *a*. and Tab. 10. **. d. 1. fig. 1. *d*. (*u*) Ibid. fig. 2. *b b*. and Tab. 11. ubi sup. *f f*. (*x*) Tab. 10. ubi sup. fig. 4, 5. and Tab. 11. fig. 6, 7, 8, 21.

character of the section. The extraordinary length of the antennæ of the males, does not arise from an increased number of articulations, for they consist only of fourteen, but from the unusual length of each joint. A singular circumstance distinguishes these antennæ, which, to the best of my knowledge, has never before been noticed, and which may possibly lead to the discovery of the use of these organs. Placed under a powerful magnifier the ten last joints appear to be composed of innumerable hexagons, similar to those of which the eyes of these insects consist (*y*). If we reason from analogy, this remarkable circumstance will lead us to conjecture that the sense, of which this part so essential to insects is the organ, may bear some relation to that conveyed by their eyes. As they are furnished with no instrument for receiving and communicating the impressions of sound, similar to the ear, that deficiency may be supplied by extraordinary means of vision. That the stemmata are of this description seems very probable, and the antennæ may, in some degree, answer a similar purpose: the circumstance just mentioned furnishes a strong presumption that they do this, at least in the case of these males: else why do they exhibit that peculiar structure which distinguishes the real eye?

The great use which insects make of their antennæ in collecting information is described in a very

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(*y*) Tab. 10 ubi sup. fig. 8.

entertaining manner, in Mr. Marsham's interesting paper upon the history of *Ichneumon manifestator*, in the third volume of the Transactions of the Linnean Society. "It moved rapidly," says he, "over the top of the post, having its antennæ bent in the form of an arch, and with a strong vibratory motion feeling about until it came to a hole made by some insect, into which it thrust its antennæ quite to the head. It remained a minute at least in this situation apparently very busy, and then drawing out its antennæ came round to the exactly opposite side of the hole, again thrust in its antennæ and remained nearly the same time. It next proceeded to one side of the hole, repeating the operation, the antennæ quivering in a surprizing manner; and having now again drawn out its antennæ, turned about, and dexterously measuring a proper distance, threw back its abdomen over the head and thorax, at the same time projecting its long and delicate tube into the hole.——after remaining near two minutes in this posture, it drew out the tube, turned round, and again applied its antennæ to the hole for nearly the same time as before.——I again paid very particular attention to some I saw in Kensington gardens, but more immediately to the action of the antennæ, which they thrust into many holes and crevices, but soon drew them out, not finding, I presume, a proper situation for their eggs(z)." Thus far this ingenious entomologist. In this instance, the antennæ appear to have been the instrument which informed the little animal both where the holes were that she was in search of, and also whether the larva, to which the Author of Nature had instructed her to commit her eggs, was in them. I have often seen the hive bee insert one of its antennæ into the blossom of a flower previous to exerting its tongue to collect the honey, as if to inform itself first whether there was any; and insects in general, when they are walking, keep perpetually moving their antennæ from side to side, as if, by their means, they were collecting information concerning what was going forward around them.

(z) P. 26, 28.

But to return to the insects of which we are treating. Miller in the MS. notes before quoted(*a*), gives the following short history of *Apis longicornis.* "*Mense Julio medio copulantur prope terram volitantes in gramine detonso. In puteo cylindrico terræ ova femina deponit.*" These cells are two or three inches below the surface of the ground; they are very smooth within, and of an oval form. I found several in the southern declivity of a grass walk, which had been frequently mowed.

**. d. 2. α. (*b*)

H. F. A. *Corpus* oblongum, villosum, interdum hirsutum; *Capite* trunco angustiori, vel subtri-

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(*a*) Vide supra, p. 61. note *z*.

(*b*) Tab. 11. **. d. 2. α. *Apis, Eucera,* Fab.

angulari, vel rotundato; *Ore* crasso; *Proboscide* apice subulato-conicâ, rectâ; *Linguâ* subinvolutâ; *Tubo* apice tridentato dente intermedio longiori; *Fulcro* elongato; *Laciniis* exterioribus articulo ultimo brevissimo, interioribus lanceolato-linearibus, quàm exteriores brevioribus; *Valvulis* rectis, apice lanceolato-lineari, subplicato, coriaceo; *Palpis* exterioribus sexarticulatis, interioribus biarticulatis; *Stemmatibus* in triangulo; *Oculis* prominulis, magnis; *Naso* convexo, distincto; *Labio* quadrato; *Maxillis* apice sæpius bidentatis; *Antennis* subclavatis, pedicello globoso, apice articulo primo elongato, basi attenuato; *Tibiis* posticis scopâ polliniferâ; *Plantis* posticis dilatatis; *Digitis* infra apicem plantæ insertis; *Unguiculis* apice bifidis; *Abdomine* vel ovato, vel subgloboso, basi retuso, segmento ultimo minuto.

Maris *Antennæ* thorace breviores. *Plantæ* posticæ angustiores, digitis ex apice plantæ provenientibus.

The insects of this section are distinguished from the preceding by two principal circumstances, the interior laciniæ are much shorter than the exterior with tops not involute, and the antennæ of the males are not so long as the thorax. The species that enter into the present subdivision of the section, differ from those of the next, in the form of their proboscis, which is subulato-conical; in the substance of the apex of the valvulæ, which is coriaceous; in the figure of their lip, which is

square; besides several other circumstances which will appear upon a comparison of their several characters. Their mode of nidification is various, which makes me suspect that there may be room for another subdivision, but this I have not yet been able to trace out. *Apis retusa* makes its nest with us in hard banks of gravel or clay, containing several cells, of an oval or elliptical shape, covered within with a thin white membrane, each being about three-fourths of an inch in length, and not quite half an inch in diameter; they are placed in no regular order. In Northamptonshire, as we learn from Ray, it makes its cells in stone walls. I found it myself in great abundance frequenting the walls built with Kettering stone at Wansford and Ufford in that county; and once, at Norwich, I was much amused at seeing a female, one sunny morning, very busily employed upon a brick wall, and exerting all her might to pull the mortar from between the bricks; but whether this was to prepare a place for a cell, or only a sheltered cavity to pass the night in, according to the observation of Rossi, I could not ascertain. Another species, belonging to this subdivision, nidificates in a manner similar to *Apis violacea*, in pieces of putrescent wood. In these they bore a longitudinal pipe, which they divide into nine or ten oval chambers, separated from each other by a sharp kind of cornice, which form the shells of an equal number of oval cells; these are made of the scrapings of the wood much masticated. Each cell is rather more than half an inch in length, and about three tenths of an inch in diameter: the partitions which separate the cells from each other are made of the same material, and are about a line in thickness. The pipe runs nearly parallel with the sides of the piece of wood in which it is bored, making an angle where it begins and where it ends, and having its entrance on the opposite side to its exit. Probably the inhabitants of the lowermost cells make their way out at the exit, and those of the uppermost at the entrance (*c*). To this subdivision belong *Apis Hispanica, pilipes, bimaculata, vulpina, quadrimaculata, furcata, rotundata* (*d*), and *Andrena strigosa* of Panzer (*e*).

**. d. 2. β. (*f*)

H. F. A. *Corpus* oblongum; *Capite* trunco angustiori, lato, rotundato, depresso; *Proboscide* breviusculâ, conicâ, rectâ, fornicatâ; *Linguâ* brevi, rectiusculâ; *Tubo* apice tridentato, dentibus æqualibus; *Laciniis* exterioribus articulo ultimo brevi; *Valvulis* apice semicordato, acuto, corneo, concavo, basis vertice eroso, sinu pectinato; *Palpis* exterioribus sexarticulatis, interioribus biarticulatis; *Facie* inæquali; *Stemmatibus* in triangulo, infra verticem sitis; *Oculis* distantibus, prominulis;

(*c*) *Apis furcata* makes these nests. (*d*) Panzer Fn. Ins. Germ. Init. n. 55. t. 6, 8, 17. n. 56. t. 6, 7, 8, 9. (*e*) Ibid. n. 64. t. 16. (*f*) Tab. 11. **. d. 2. β. fig. 19, 20, 21. *Apis,* Fab. Latr.

Naso planiusculo, tuberculo munito; *Labio* anticè emarginato, setoso; *Maxillis* apice bidentatis; *Antennis* subclavatis, pedicello globoso, apice articulo primo elongato, basi attenuato; *Trunco* plerisque hirsuto; *Alis* subcoriaceis, coloratis; *Tibiis* posticis brevibus, scopâ polliniferâ vestitis; *Plantis* posticis elongatis, hirsutissimis; *Digitis* ex apice plantæ provenientibus; *Unguiculis* bifidis; *Abdomine* oblongo, basi retuso, supra plerisque glabriusculo, lateribus hirsutis, ano rotundato, ventre planiusculo.

Maris *Oculi* magni, sæpe approximati. *Tarsi* tenuiores, minùs hirsuti.

This subdivision, which contains *Apis violacea*, Lin., and its affinities, may be known by the following peculiarities. The summits of the valvulæ, which are short, wide, and of a hard, corneous substance, connive into the longitudinal section of a cone, and form a strong arch over the tongue. The head is rounded, the space between the eyes is ample, the lip is strengthened by a tubercle, and is emarginate before, and beset with numerous bristles. The abdomen, in most, is hairy only on its sides, rather convex above, and flattish underneath. The wings are coloured, often of a brilliant purple or violet, and usually of a substance between coriaceous and membranous. Concerning the proboscis of these insects, I am able to say but little, except as to its exterior figure, since I have had an opportunity of examining only one, that I had extracted from an old specimen of *Apis violacea*, in which it was mutilated, so that I could not discover the shape of the interior laciniæ. The valvulæ, however, exterior laciniæ, and palpi were uninjured. The only species that I have ever seen, belonging to this subdivision, which claims to have been taken in England, is *Apis iricolor* of the following pages; but its claim is not established with certainty, for Dr. Latham, from whose collection I received it, is not quite decided in his opinion upon this point; but as he has always placed it in his cabinet with his English insects, I have considered it as such; which I was the more inclined to do, in order to lay down the characters of the subdivision to which it belongs, the individuals of which have been universally confounded with the *Bombinatrices*; from which, however, they are distinguished by the striking characters mentioned in my observations upon the first section of the family (*g*). Whether all of them nidificate in the same way with *Apis violacea*, I am not able to say, it is probable they may. Reaumur has given us a very interesting account of the proceedings of that bee, which I shall now abridge.

"The mother bee usually makes her appearance early in the year, as soon as the winter is over; she may then be met with in gardens, visiting such walls, as are covered with trees trained upon trellis work, in a warm sunny aspect; when once she has

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(*g*) Vide supra, p. 183.

begun to make her appearance, she frequently returns, and during a long period; and she may always be known by her size, and her hum, which much resembles that of the *Bombinatrices*. The object of her earlier visits is to fix upon a piece of wood proper for her purposes. She usually selects the putrescent uprights of arbours, espaliers, or the props of vines; but sometimes she will attack garden seats, thick doors, and window shutters; the piece that she chooses is commonly cylindrical and perpendicular to the horizon. Her strong maxillæ are the instruments which she employs in boring it: beginning on one side for a little way she points her course obliquely downwards, and then proceeds in a direction parallel with its sides, till she has bored a tunnel of from twelve to fifteen inches in length, and seven or eight lines in diameter. Sometimes three or four of these tunnels, or pipes, nearly parallel with each other, where the diameter will admit of it, are bored in the same piece. A passage is left where she enters or first begins to bore, and another at the other end of the pipe. As the industrious animal proceeds in her employment, she clears away the wood, which she detaches, throwing it out upon the ground, where it appears like a small heap of saw-dust. Thus we see she has prepared a long cylinder in the middle of the wood, sheltered from the weather and external injuries, and fit for her purposes. But how is she to divide it into cells? What materials can she employ for making the floors and ceilings of her miniature apartments? Why, truly, God "doth instruct her to discretion, and doth teach her (*h*)," the saw-dust just mentioned is at hand, and this supplies her with all that she wants to make this part of her mansion complete. Beginning at the bottom of the cylinder she deposits an egg, and then lays in a store of pollen mixed with honey sufficient for the nutriment of the little animal it is to produce. At the height of seven or eight lines, which is the depth of each cell, she next constructs, of particles of the saw-dust glued together and also to the sides of the tunnel, what may be called an annular stage, or scaffolding; when this is sufficiently hardened its interior edge affords a support for a second ring of the same materials, and thus the ceiling is gradually formed of these concentric circles, till there remains only a small orifice in its center, and this is also filled up with a circular mass of agglutinated particles of the saw-dust. This partition exhibits the appearance of as many concentric circles as the animal has made joinings (*i*), and is about the thickness of a French crown-piece; it serves for the ceiling of the lower, and the floor of the upper apartment. One cell being completed, she proceeds to another, which she furnishes and finishes in the same manner, and so on till she has divided her whole tunnel into apartments, which are usually about twelve. The

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(*h*) Isai. xxviii. 26. (*i*) Reaum. tom. 6. tab. 6. fig. 4, 5.

larvæ and pupæ of these, do not differ materially from those of other Bees; when the former assumes the pupa, it is placed in its cell with its head downwards, a very wise precaution, for thus it is prevented, when it has attained to its perfect state, and is eager to emerge into day, from making its way out upwards, and disturbing the tenants of the superincumbent cells, who being of later date, each than its neighbour below stairs, are not yet quite ready to go into public(*k*)." Thus far, for the most part, from our author.

To this subdivision belong, besides *A. violacea, A. Caffra, latipes, nigrita, Tranquebarorum, æstuans, Brazilianorum, Virginica, cingulata, Africana,* &c. &c.

**. e. 1.

H. F. Neut. *Corpus* ferè lineare, pubescens; *Capite* trunci propè latitudine, triangulari; *Proboscide* subinvolutâ; *Linguâ* rimâ longitudinali; *Tubo* sublineari, apice truncato; *Fulcro* subtriangulari; *Laciniis* exterioribus membranaceis lineâ longitudinali corneâ, articulo extimo breviori; interioribus brevibus, obtusis, linguæ basin arctè amplectentibus; *Valvulis* apice lineari-lanceolato, subplicato, ex corneo submembranaceo, lineâ longitudinali corneâ; *Palpis* exterioribus exarticulatis acutis, interioribus biarticulatis; *Facie* inæquali;

(*k*) Reaum. tom. 6. Mem. 2.

(*l*) Tab. 11. **. e. 1. and tab. 12. Adams on Micros. tab. 13. fig. 3. *Apis,* Fab. Latr.

Stemmatibus in triangulo; *Oculis* pilosis; *Naso* distincto, convexo; *Labio* transverso, sublineari, planiusculo; *Maxillis* forcipatis, medio constrictis, apice edentulis obliquis; *Antennis* filiformibus, scapo fusiformi, pedicello subgloboso; *Tibiis* posticis compressis, supra glabris, margine omni recurvo-ciliatis *ſ.* corbiculâ instructis, apice inermibus *ſ.* absque spinulis; *Plantis* posterioribus dilatatis, basi auriculatis auriculâ acutâ, intus scopulâ transversè striatâ striis setoso-pectinatis, vestitis; *Unguiculis* bifidis; *Abdomine* subprismatico, basi retuso, tergo convexo.

Feminæ *Proboscis* brevis. *Lingua* paulò infra apicem constricta. *Tubus* apice tridentatus, dentibus lateralibus obsoletiusculis, intermedio subemarginato. *Valvulæ* rectiusculæ. *Maxillæ* apice dentibus armatæ. *Tibiæ* posticæ supra, nec margine, pilosæ. *Plantæ* posticæ absque auriculâ. *Abdomen* elongato-conicum

Maris *Corpus* crassius; *Caput* ex globoso depressum, ferè circulare. *Proboscis* brevis, crassior. *Lingua* tenuis. *Valvulæ* latiores. *Maxillæ* apice dentibus armatæ. *Tibiæ* posticæ corbiculâ nullâ. *Plantæ* posticæ absque auriculâ et scopulâ. *Abdomen* subcordatum, obtusum.

The family of which this is the first section, is distinguished from that which precedes it by a subinvolute proboscis, and a triangular fulcrum; by membranaceous exterior laciniæ and valvulæ, with a longitudinal corneous line; by exterior palpi, consisting, as far as I can discover, of a single

joint only; by maxillæ dilated at their apex; by filiform antennæ, the first joint of the apex not being attenuated at its base; by posterior tibiæ furnished with a corbicula or little basket for carrying wax; by the auricles which are observable at the base of the posterior plantæ, and by their prismatical abdomen. Besides these differences, the individuals of it are distinguished in their economy from all other bees, by two remarkable circumstances, they are gregarious, and they make wax: reasons surely sufficient and satisfactory for separating them from the false *Bombinatrices*, *A violacea* and its affinities. Agreement with the genuine *Bombinatrices* in these peculiarities will sufficiently justify me for considering *A. mellifica* as belonging to a subdivision of the same family. Indeed, the single circumstance that the ALL WISE AUTHOR of nature has instructed these alone of all others to make wax and live together in societies, is the strongest of all possible proofs of their affinity. Reaumur, whose judgment ought to have great weight in these matters, was evidently, in this respect, of the same opinion with myself, for he places the *Bombinatrices* next to *A. mellifica*, and looks upon them as related to each other in the same degree that the rude cottagers of a country village are to the more polished inhabitants of a populous city (*m*).

(*m*) Reaum. ubi supr. Pref. p. 3.

This section, besides *A. mellifica*, contains several other species, three very distinct ones I observed in Mr. Drury's cabinet, of which one came from Bengal, another from Madras, and a third from the Cape of Good Hope; an equal number, still different, may be seen in Sir J. Banks's rich collection. All these species have the transversely striated posterior scopulæ, which has usually been looked upon as the exclusive character of the common hive bee, like this too they have no spines at the apex of the third pair of tibiæ, a very peculiar circumstance by which the insects of this section of the present family are distinguished, not only from all other *Apes*, but also from every other individual of the Class *Hymenoptera* that I have had an opportunity of examining. It is worth inquiry whether the mode of nidification of all, or any of the wild bees that belong to this section, be similar to that of the cultivated one; should it turn out so, as I think it most probably would, as all have the same instruments, they might, perhaps, be domesticated in countries where the common one may not yet be introduced; or some of them may have been domesticated and mistaken for the common one.

Linneus, in his Systema Naturæ, says under *A. mellifica*: "Femina—antennis articulis decem—Mares—antennis undecimarticulatis—Operariæ—antennis quindecimarticulatis." In every one of these assertions, with due deference to a name so deservedly great be it spoken, he is mistaken, for the antennæ of the female and neuter consist of the same number of articulations exactly, viz. thirteen, including the radicle (*n*): those of the male have fourteen joints (*o*), although the fourth and fifth, counting from the head, under any but a very powerful magnifier, appear to be but one. Many other authors have fallen into similar mistakes on this head. Swammerdam says, if Hill rightly translates him, for I have not the original by me, that the antennæ of the working bees have only five joints, while those of the males and females have eleven (*p*). Reaumur gives only twelve joints for the antennæ of the neuter, including the radicle (*q*). Geoffroy says that those of the female and neuters consist of fifteen articulations, and those of the male of eleven only, he affirms also that the abdomen of the female consists of seven segments, instead of six, which is the real number (*r*). Scopoli finally reduces the number of articulations of the antennæ of the female to ten (*s*).

A bulky volume would scarcely suffice for a complete account of the history, economy, mode of culture, &c. of the hive bee; I shall not, therefore, at this time enter upon it, but content myself with referring my reader to the elaborate treatises

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(*n*) Tab. 12. e. 1. fem. fig. 6. and neut. fig. 13.

(*o*) Tab. 11. e. 1. mas. fig. 5.

(*p*) Hill's Swam. pt. 1. p. 167. I think there must be some mistake here.

(*q*) Reaum. tom. 5. Mem. 6. p. 282. tab. 25. fig. 4.

(*r*) Geoff. Hist. Ins. 2. p. 386, 387.

(*s*) Ent. Car. n. 811.

of Swammerdam, Reaumur, Huber, Wildman, the entertaining dialogues of the Spectacle de la Nature, &c. where he will see what a wonderful display of the Divine Wisdom these little creatures exhibit, and in how extraordinary a manner, by their various instincts and operations, *ὡς δι εσοπτρȣ εν αινιγματι* (*t*), if he can solve it, they reflect the glory of God.

**. e. 2. (*u*)

H. F. A. *Corpus* oblongum, hirsutissimum; *Capite* trunco angustiori, sæpius triangulari; *Proboscide* plùs minùs involutâ; *Linguâ* rimâ longitudinali; *Tubo* lineari apice acuto; *Fulcro* subtriangulari; *Laciniis* exterioribus membranaceis lineâ longitudinali corneâ, articulo extimo brevi; interioribus brevissimis, obtusis, linguam arctè amplectentibus; *Valvulis* apice lanceolato-lineari, submembranaceo, lineâ longitudinali corneâ; *Palpis* exterioribus exarticulatis, interioribus biarticulatis; *Vertice* calvo cruce impresso; *Stemmatibus* in lineâ curvâ, in crucis fossulâ transversâ sitis; *Naso* distincto, convexo, glabro, nitido; *Labio* transverso, sublineari, inæquali; *Maxillis* supra sulcatis sulcis tomentosis, apice dilatatis subedentulis; *Antennis* filiformibus, scapo subclavato, pedicello globoso, apice articulo primo longiori subconico; *Tibiis* posticis corbiculâ instructis, supra inæqualibus, glabris, apice setoso-pectinatis; *Plantis* posticis dilatatis, basi auriculatis auriculâ obtusâ, apice pec-

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(*t*) 1. Cor. xiii. 12.

(*u*) Tab. 13. *Apis,* Fab. Latr.

tine e setis instructis; *Digitis* articulis spinuloso-setosis; *Scopulis* plerumque auratis; *Unguiculis* apice bifidis; *Abdomine* oblongo, interdum et subtriangulari, subprismatico, basi retuso, supra convexo, ano acutiusculo.

Maris *Maxillæ* minores, apice bidentatæ, dente interiori minuto, barbatæ barbâ incurvâ, supra tomentosæ. *Tibiæ* posticæ nec corbiculâ neque pectine instructæ, plerisque supra pilosæ. *Plantæ* posticæ absque auriculâ. *Anus* obtusiusculus.

Obs. In hâc familiâ *In. alæ superioris reticulationis areolâ marginali striga nigricans plerumque includitur* (*x*); *pedum geniculi extus sæpius tomentoso-pallidi; tarsi e pilis sparsis decumbentibus certo situ vel subincani vel fulvescentes; sub luce scopulæ plurimorum aureo splendore micant.*

The principal characters, besides their hirsute body, which distinguish the *Bombinatrices* from the hive bee and its affinities, are the cross impressed upon their vertex, their stemmata arranged in a curve, instead of a triangle, their lip unequal in surface, their maxillæ sulcate on their upper side, and the spines which arm the apex of their posterior tibiæ; besides this the females, as well as the neuters, are furnished with the corbicula, and with the auricle at the base of the plantæ of the last pair of legs, not to mention other slighter differences; in other respects the individuals of both sections of this family exactly agree together.

(*x*) Tab. 13. fig. 17. *a.*

With respect to the history, economy, &c. of the *Bombinatrices*, I cannot do better than abridge the account of these which Reaumur has given us, first observing that the females usually make their appearance early in the spring, as soon as the catkins of the different species of *Salix* are in blossom, upon which at this time they may commonly be seen, collecting honey from the female, and pollen from the male catkins, although I have also seen them employ their tongue in the latter; the appearance of the neuters is later, and the males are most common in the autumn, when the thistles are in blossom, upon the flowers of which they are abundant, sometimes seemingly asleep, or torpid, at others acting as if intoxicated with the sweets they have been imbibing. When these animals, of any sex, are walking upon the ground, if a finger be moved to them, they lift up the three legs of one side to defend themselves, which gives them a very grotesque appearance. Their nests are often found in meadows and pastures, sometimes in groves and hedge-rows, where the soil is entangled with roots, and now and then in heaps of stones.

"When they do not meet with an accidental cavity ready made, they excavate one themselves with great labour, which they cover with a thick convex vault or coping of moss, the interior surface or roof of which is sometimes cased or ceiled with a kind of coarse wax, in order to keep out the wet. At the lower part of the nest is an opening for its inhabitants to go in and out at; this entrance is often through a long gallery, or covered way, sometimes more than a foot in length, by means of which the nest itself is more effectually concealed from observation. The mode in which they transport the moss they use is singular: it must be observed that they employ such only as grows upon the ground. When they have discovered a parcel of this conveniently situated, they place themselves upon it, with their anus towards the spot to which they mean to convey it: they first take a small portion, and with their maxillæ and fore-legs, as it were, card and comb it; when the pieces are sufficiently disentangled, they are placed under the body by the first pair of legs, the intermediate pair receives them, and delivers them to the last, which pushes them as far as possible beyond the anus. When, by this process, the insect has formed behind it a small mass of moss well carded, then, either the same, or another who takes her turn in the business, pushes it nearer to the nest. Thus small heaps of prepared moss are conveyed to its foot, and in a similar manner they are elevated to its summit, or wherever they may be most wanted. A file of four or five insects is occupied at the same time in this employment. These nests are often six or seven inches in diameter, and elevated to the height of four or five above the surface of the ground. When the covering of moss is taken from the nest, the first thing that presents itself is an irregular comb, composed of an assemblage of oval bodies disposed one against another: under this there is sometimes another, which itself is placed upon a third, none of these are united together: sometimes, however, there is only one. These combs vary in size, and are not to be compared, either for the regularity of their form, or of the parts that compose them, with those of the hive bee. They consist of a number of oblong or oval cells, or coccoons, spun by the larvæ when they are about to undergo their first change, for these insects make no waxen cells for their young: they are made of a kind of silk, and fastened together. These cells are of three dimensions, answering to the three sexes, which circumstance produces the inequalities observable in the surface of the combs. The void spaces between the cells are filled with masses of brown paste, made of gross wax, or pollen much wrought, and honey. Besides the masses, they attach to every comb, particularly the uppermost, three or four cells in the shape of goblets, open at the top, and full of liquid and very sweet honey, and made of the same kind of coarse wax that the roof is ceiled with. The first step towards furnishing a nest is to make a mass of the brown paste, and one of these honey-pots. The masses of paste, which are sometimes as big as small nuts, are intended for the food of the larvæ, and in them the eggs are deposited. These vary in number, from three to thirty being to be found in one mass, but not all in the same cavity: they are oblong, of a bluish white, a line and half in length, and half a line in diameter. The larvæ are similar to those of the hive bee, but their sides are marked by irregular transverse black spots. These larvæ, after they are hatched, separate from each other, eating the paste which surrounds them. The bees of the nest, it is probable, discover the places where the layers of this material become too thin, or where the larva is in danger of eating through it, and lay upon such parts fresh paste, that it may be sheltered from the air. The honey-pots may be intended to supply honey for the occasional moistening of the paste. The pupa in each cell is placed with its head downwards, and makes its way out at the bottom of its coccoon. When the larva has spun this, the bees probably take the pains to clear it from the paste that may remain upon it.

" The nests seldom contain more than fifty or sixty inhabitants, these are of three different sizes; the females, of which there is more than one in a nest, are the largest, and probably alone survive the winter; the males are of the middle size, as is also one description of working bees, or neuters; the other neuters are the smallest, and not bigger than the hive bee (y). These two sorts of neuters, it is most likely, are appropriated to different kinds of work; the largest being the strongest, and the others the most lively, active, and expert. Amongst the *Bombinatrices*, the females and males have not the privilege of doing nothing, as is the case with the hive bee, but all work in concert to repair any damage or derangement that may befall their habitation. Every nest of these bees, as our author supposes, is at first very small, being originally constructed and inhabited by a single female, but the eggs which she there deposits soon produce her a numerous progeny. The nests of the Humble Bees are exposed to the depredations of various foes; ants, the larva of *Asilus crabroniformis*, several other *Diptera*, and some *Tineæ* attack them, but the field mice and polecats are their greatest enemies (z)."

(y) They are often much smaller. K.

Thus far this admirable author. He suspects that these insects swallow the pollen which they use for making their paste, and return it again properly moistened, as he did not often observe any little masses of wax, or wrought pollen (*a*) upon their posterior tibiæ, at least not so constantly as would be necessary to supply the quantity requisite for their consumption; yet the females and neuters are furnished with the corbicula, or little basket necessary for that purpose, and I have myself frequently seen them with these masses.

Geoffroy has given an account of the nidification of these insects, totally at variance with this of Reaumur,

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(z) Reaum. tom. 6. Mem. 1.

(*a*) Much curious information upon this subject, is contained in a paper, sent by M. Huber the younger, to the Linnean Society, which I do not think it right to forestall

Reaumur, and equally so, I apprehend, with truth and nature. He says, " that they make spacious subterraneous apartments, in which they construct their combs, consisting, like those of the hive bee, of hexagonal cells, but composed of different materials, their substance being like parchment, and made of small particles of rotten wood formed into a paste, by means of a glutinous liquor with which nature has furnished them: that in these cells they deposit their eggs, supplying them with a sufficient quantity of honey: that these combs are surrounded with a thick border, consisting of thin laminæ resembling dry leaves, and made of the same material with the cells (*b*)." This account so accurately describes a wasp's nest, that I cannot help suspecting that it was taken from one. I believe no *Bombinatrix* was ever found to nidificate in this manner.

I shall add here what Ray has observed upon the same subject. " Eulæ," says he, " ut et aliorum generum, glabræ sunt, colore carneo-albicante, in annulos divisæ, ventre planiore, dorso gibbo et elato, rostro acutiore, caudâ obtusiore; erithacâ aut materiâ quâdam erithacæ simili circundatæ, quæ eis pro alimento inservit, in quâ latitantes, in globulum ferè convolvuntur, caudâ ad caput adductâ, Asellorum instar. Cum justam magnitudinem adeptæ sunt, folliculos validos et velut coriaceos sibimetipsis texunt, iisque inclusæ in nymphas mu-

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(*b*) Hist. Ins. Par. 2. p. 404, 405.

tantur, cùmque maturuere, ut ita dicam, et debitam perfectionem et partium soliditatem assecutæ sunt, disrupto aut exeso folliculo Apum formâ prodeunt. In folliculos unde Apiculæ evolârunt mel congerunt (*c*)."

I know no family of which it is more difficult to distinguish the species than the present; for there is little difference in the form of the *Bombinatrices*, and the hue of their bodies, at least of all our English ones, is the same, so that the describer must rely almost solely upon the colour of their hirsuties for his characters, and this is so subject to vary, even in the same individual, in different periods of its existence, that it is not safe to depend upon it but under particular restrictions. An insect recently disclosed, in this respect, appears a different species from the same when it has been long exposed to wind and weather. Thus, for instance, *A. Muscorum*, which, when fresh from the pupa, is distinguished by a thorax covered with hair of a fine orange colour, and by an abdomen whose coat is a rich yellow, when it grows old, especially the male, exchanges these brilliant colours for a cinereous hue, which circumstance misled Fabricius to give it as a distinct species, under the name of *A. senilis*. But not only yellow and red, but even black and white hairs are apt to change their colour through age. All these circumstances make it a matter of some importance, to be able to distinguish a

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(*c*) Ray. Hist. Ins. p. 246-7.

recent insect from one that has been long disclosed: this may often be done by inspecting the state of its wings, for in the latter, especially in males, they are usually lacerate at the apex, the body too has frequently a good deal of its hair rubbed off. It will not be without use to know into what the predominant colours fade: yellow will usually first turn pale, and then cinereous; red will turn through tawny to yellow, and sometimes to cinereous; white will turn to pale, and sometimes to tawny, and black will now and then turn white. But this is not all the difficulty with which the describer of the *Bombinatrices* has to struggle: the males in general resemble the females sufficiently to be known as such, but there are several so unlike them, as to be easily mistaken for different species; and I am by no means certain that I have not, in more instances than one, described the sexes under different names: till all can be traced to their nidi this is not easy to be avoided. In my arrangement of the species of this section, I have observed the following rules, which, for the most part, were suggested by the evident affinities of these insects. I begin with those whose general hirsuties is pale yellow, while that of the thorax is orange; after these follow such as have the same coloured hair, but whose thorax has a black band(*d*); next I place such as are distinguished by the colour

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(*d*) *A. sylvarum,* Lin. has a red anus, but its general habit gives it a strong affinity with those that precede it.

of their anus, whether yellow, white, or red, and finally come such as are entirely black.

After my *Synopsis Specierum*, containing the above arrangement, was printed, I discovered, what had escaped me before, that four different species, one of which had a yellow, two a white, and one a red anus, were deprived of some of the characters of the *Bombinatrices*, having neither corbicula, nor pecten at the apex of the tibiæ, nor auricle at the base of the plantæ, of the posterior legs, at the same time exhibiting some peculiar to themselves. This circumstance offers an opportunity for a natural subdivision of this section of the family, founded upon other characters than colour; the following peculiarities distinguish the members of it; in their proboscis, and other respects, they agree exactly with the others.

Labium antice obtusangulum (*e*).
Maxillæ forcipatæ, apice obliquè truncatæ (*f*).
Tibiæ posticæ supra convexæ, pilosæ, nec corbiculâ, neque pectine instructæ (*g*).
Plantæ posticæ absque auriculâ (*h*).
Abdomen oblongum, ano, in mortuo, sæpius inflexo; ventre segmento ultimo in angulum utrinque protenso (*i*).

Maris *Maxillæ* apice bidentatæ. *Abdomen* triangulare, incurvum, subacuminatum.

(*e*) Tab. 13. fig. 12.
(*f*) Ibid. fig. 37.
(*g*) Ibid. fig. 22. *a*.
(*h*) Ibid. fig. 23.
(*i*) Ibid. fig. 25. *aa*.

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The females and neuters of these insects, it is probable, do not, like the rest of the *Bombinatrices*, carry masses of wrought pollen upon their hind-legs, or they would have been furnished with a corbicula for that purpose; from the absence of the pecten of the posterior tibia, and of the auricle at the base of the planta, which are usually concomitants of the corbicula, we may conjecture that these instruments, which are over against each other, are given to the insects which have them, for the purpose of preparing their little masses of pollen; the pecten, which consists of strong bristles, probably breaking the grains, and the auricle assisting to knead them into a paste, previous to their being laid upon the tibia. It is remarkable that the females and neuters of these *Apes*, should exhibit those characters which are peculiar to the males of the rest of the family. I suspect that they nidificate under-ground.

To this subdivision belong *A. campestris* (*k*), *A. Barbutella* (*l*), *A. vestalis* (*m*), and *A. rupestris* (*n*) of this work; likewise, as I suspect, *A. mystacea* of Christius (*o*), and *A. arenaria* of Panzer (*p*).

(*k*) Tom. 2. p. 335. (*l*) Ibid. p. 343. (*m*) Ibid. p. 347.
(*n*) Ibid. p. 369. (*o*) Hymenopt. p. 124. tab. 6. fig. 3.
(*p*) Fn. Ins. Germ. Init. n. 74. tab. 12.

ADDENDA.

ADDENDA.

HAVING had an opportunity, since the preceding pages of this volume were printed, of examining a large number of *Hymenopterous* insects, and having likewise made some forther observations upon the foregoing families, more particularly with respect to the wings, that had before escaped me, I shall subjoin them here, beginning with the latter.

I must first observe in general, that the surface of every superior wing may be looked upon as divided into three parts, which may be denominated Alæ *Basis, Medium, et Apex.*

Basis. Alæ portio thoraci proxima ex areolis tribus elongatis constans, intermediâ breviori, inter alæ nervos divergentes inclusis (*q*).

Medium. Alæ portio intermedia, reticulata, areolas sex vel septem, figurâ et magnitudine varias, et anastomosin includens (*r*).

Apex. Alæ portio extima, dilatata, obliquè truncata, in angulum obtusum cum margine tenuiore, *ſ.* basis areolâ infimâ, subtus concurrens (*s*); in areolas tres subæquales, mediantibus venis duabus rectis, sæpius distincta; superficie undulato-crispante, plerisque punctulatâ (*t*).

(*q*) Tab. 3. **. b. fig. 5. *d.* (*r*) Ibid. *e.*
(*s*) Ibid. *g.* (*t*) Ibid. *f.*

The inferior wings, as to superficies, are similar to the superior, only they want the reticulate portion or medium, and therefore can only be distinguished into *Basis* and *Apex*, which are divided into areas in a similar manner with the superior wings(*u*).

MELITTA.

*. a. *Alæ Superiores.* Nervi costales distincti. Anastomosis distincta. Medium areolis septem.

——*Inferiores* semi-ovales, sessiles; margine crassiori rectiusculo, tenuiori trifido.

*. b. *Alæ Superiores.* Nervi costales distincti. Anastomosis distincta. Medium areolis sex (*x*). Apex impunctulatus.

——*Inferiores* semi-ovales; sessiles; margine crassiori subundulato, tenuiori trifido.

As a further proof that the insects of this family are not all varieties of the same species, I shall describe one belonging to it, which is evidently distinct. It is in Sir Joseph Banks's cabinet, and came from New South Wales. It should come next to *M. signata*(*y*), which stands with it in the same cabinet, from the same country.

cyanura. M. atra; fronte maculata; scutello puncto flavo; abdomine atro-cærulescenti.

MUS. *D. Banks*, Sphex, *in serie quintâ a sinistr. e tribus ultimis specimen medium.*

(*u*) Tab. 13. fig. 18. (*x*) Tab. 1. *. b. fig. 7. *b.*

(*y*) Tom. 2. p. 41.

Long. Corp. Lin. $3\frac{1}{2}$.

Hab. In Novâ Cambriâ.

DESCR. Acul.

CORPUS atrum, glabrum.

CAPUT. *Frons* utrinque ad oculos maculâ magnâ irregulari flavescente. *Antennæ* nigræ.

TRUNCUS. *Collare* utrinque flavum. *Tubercula* flava. *Scutellum* puncto rotundo flavicanti insignitum. *Squamulæ* nigræ. *Alæ* subhyalinæ, nervis nigris. *Pedes* nigri.

ABDOMEN nitidissimum, atro-violaceum, lucidum, levissimè punctulatum.

**. a. *Alæ Superiores.* Nervi costales distincti. Anastomosis distincta. Medium areolis septem. Apex minutissimè punctulatus.
——*Inferiores* semi-ovales, sessiles; margine crassiori rectiusculo, tenuiori trifido.

**. b. *Alæ Superiores.* Nervi costales distincti. Anastomosis distincta. Medium areolis septem. Apex minutissimè punctulatus.
——*Inferiores* semi-ovales, subpetiolatæ; margine crassiori rectiusculo, tenuiori trifido.

**. c. *Alæ Superiores.* Nervi costales distincti. Anastomosis distincta. Medium areolis septem.
——*Inferiores* semi-ovatæ, subpetiolatæ; margine crassiori subundulato, tenuiori trifido.

Obs. M. Swammerdamellæ *alarum superiorum nervi costales subcoaliti, medium areolis tantummodo sex, unde* Apum *familiæ* ✱. a. *forsan amandanda.*

Since I wrote my observations upon this family, I have received, by the kindness of M. Latreille, that curious insect, hitherto unknown to other entomologists, the Abeille tapissiére of Reaumur(z), under the name of *A. Papaveris.* Upon examining it, I find that it is no *Melitta,* as at first I suspected, but a genuine *Apis,* belonging to the second section (✱✱. c. 2.) of my family "*labio inflexo elongato.*" In habit it approaches nearest to the *Leaf Cutters* (α), but its abdomen is more convex, and as its habits and economy are somewhat different, it may belong to a new subdivision. As I could not examine its proboscis without running risk of destroying my only specimen, I am unable to say of how many joints the palpi consist. As M. Latreille intends to describe it himself, in a paper he is preparing upon the Bees of the environs of Paris, I must refer my reader to that paper, when it makes its appearance.

APIS.

✱. a. *Alæ Superiores.* Nervi costales subcoaliti. Anastomosis subdistincta. Medium areolis sex.

(z) Supra p. 142, 143.

Alæ Inferiores semi-ovatæ, subpetiolatæ; margine crassiori subundulato, tenuiori trifido

*. b. *Alæ Superiores.* Nervi costales coaliti. Anastomosis distincta. Medium areolis septem.

——*Inferiores* semi-ovales, sessiles; margine crassiori rectiusculo, tenuiori bifido.

**. a. *Alæ Superiores.* Nervi costales coaliti. Anastomosis obsoleta. Medium areolis septem, marginali nebulam includente. Apex valde dilatatus.

——*Inferiores* semi-ovales, subpetiolatæ; margine crassiori subpetiolato tenuiori trifido.

**. b. *Alæ Superiores.* Nervi costales coaliti. Anastomosis subdistincta. Medium areolis septem.

——*Inferiores* semi-ovatæ, subsessiles; margine crassiori subundulato, tenuiori bifido.

**. c. 1. α. *Alæ Superiores.* Nervi costales coaliti. Anastomosis vix distincta. Medium areolis sex, marginali nebulam includente. Apex admodum dilatatus.

——*Inferiores* semi-ovatæ, subsessiles; margine crassiori subundulato, tenuiori bifido.

**. c. 1. β. *Alæ Superiores.* Nervi costales coaliti

Anastomosis obsoleta. Medium areolis sex, marginali nebulam includente.
——*Inferiores* semi-ovales, sessiles; margine crassiori rectiusculo, tenuiori bifido.

**. c. 2. α. *Alæ Superiores.* Nervi costales coaliti. Anastomosis subdistincta. Medium areolis sex.
——*Inferiores* semi-ellipticæ, sessiles; margine crassiori subundulato, tenuiori bifido.

**. c. 2. β. *Alæ Superiores.* Nervi costales coaliti. Anastomosis obsoleta. Medium areolis sex, marginali nebulam includente. Apex admodum dilatatus.
Inferiores semi-ovatæ, subpetiolatæ; margine crassiori subundulato, tenuiori bifido.

Since I wrote my remarks upon this family, during my absence from home, five of the pupæ which Sir Thomas Cullum sent me, produced perfect insects, viz. three males, and two females; which proved, as I suspected, *A. manicata*, Lin. They make their way out at the perforated end of the cell, separating a circular portion from it (*a*).

**. c. 2. γ. *Alæ Superiores.* Nervi costales subcoaliti. Anastomisis distincta. Medium areolis sex. Apex vix punctulatus.

(*a*) Vid. supra, p. 173, &c.

Alæ Inferiores semi-ovatæ, subsessiles; margine crassiori rectiusculo, tenuiori trifido.

**. c. 2. δ. *Alæ Superiores.* Nervi costales subcoaliti. Anastomosis subdistincta. Medium areolis sex, marginali nebulam includente.

—— *Inferiores* semi-ovatæ, petiolatæ; margine crassiori subundulato, tenuiori bifido.

**. d. 1. *Alæ Superiores.* Nervi costales distincti. Anastomosis obsoleta. Medium areolis sex. Apex venis abbreviatis.

—— *Inferiores* semi-ovatæ, subpetiolatæ; margine crassiori subundulato, tenuiori trifido. Apex venis tribus.

**. d. 2. α. *Alæ Superiores.* Nervi costales subcoaliti. Anastomosis obsoleta. Medium areolis septem. Apex dilatatus admodùm, avenius, venarum loco lineis duabus elevatiusculis, impunctulatis insignitus.

—— *Inferiores* semi-ovatæ, subpetiolatæ; margine crassiori subundulato, tenuiori bifido. Apex venis duabus.

**. d. 2. . *Alæ Superiores* coloratæ, coriaceæ. Nervi costales coaliti. Anastomosis obsoleta. Medium areolis septem. Apex dilatatus admodùm.

Alæ Inferiores coloratæ, coriaceæ, semi-ovatæ, magnæ, subpetiolatæ; margine crassiori subundulato, tenuiori trifido.

**. e. 1. *Alæ Superiores.* Nervi costales coaliti. Anastomosis obsoleta. Medium areolis septem, marginali lineari, elongatâ. Apex minutissimè punctulatus.

——*Inferiores* semi-ovatæ, subsessiles; margine crassiori rectiusculo, tenuiori bifido. Apex venis tribus.

Maris *Alæ Superiores* majores, nervis costalibus distinctis. *Inferiores* latiores, semi-ovales, sessiles.

**. e. 2. *Alæ Superiores.* Nervi costales coaliti. Anastomosis obsoleta. Medium areolis septem, marginali nebulam includente. Apex dilatatus admodum.

——*Inferiores* semi-ovatæ, petiolatæ; margine crassiori subundulato, tenuiori bifido.

ADDITIONAL REMARKS ON THE HYMENOPTEROUS GENERA.

SIREX. Linneus's *Artificial Character* of this genus wants some correction. "*Os* maxillis duabus validis," for reasons before assigned (*b*), should be

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(*b*) Supra, p. 21.

be omitted. "*Palpi* duo truncati," would be better altered, admitting it to be a constant character, to "*Palpi* exteriores capitati;" since these insects, unless they depart from the general analogy of the class, have four palpi. It having never been my fortune to take one of this genus, I have not had it in my power to examine the proboscis. In *S. gigas* the exterior palpi are capitate, with a subrotund capitulum, in a male sent to Mr. Marsham as *S. Mariscus*, (but which appears to me a distinct insect), this capitulum is obliquely truncate, in both these the palpi are very hirsute. The next of the characters of Linneus "*Antennæ*—articulis ultra 24," is contrary to fact. In no species, that I have had an opportunity of examining, do they exceed 24. The antennæ of *S. Columba*, fem. counting the minute joint that connects them with the head, and those of *S. Camelus*, have only fourteen. Those of that above-mentioned, labelled *S. Mariscus*, have sixteen. In *S. Spectrum*, mas, *S. albicornis*, fem. *Fab.* and *S. Juvencus*, fem. they amount to twenty-two. In one very like *S. Juvencus*, from America, given me by Major General Davies, they have eighteen joints; in *S. Dromedarius* they have only thirteen; and finally in *S. gigas*, they reach the number, which Linneus has given as less than their lowest sum, twenty-four. From these facts I cannot help thinking that Linneus intended to have given it "*Antennæ* articulis *infra* 24," and that the word *ultra* got in accidentally.

dentally. "*Abdomen* sessile mucronatum" is an excellent character, and in my idea distinguishes the genuine from the illegitimate *Sirices.* Other characters constantly distinguish this genus, some of the most prominent are the following: the tarsi are remarkably elongate; the truncus is retuse at each end, so as to receive both the head and abdomen; when these sit close to it, the body looks as if it was formed of one piece; the body is cylindrical, and in the male every where of equal diameter, or filiform; in the females, at the insertion of the aculeus, the venter swells into an obtuse angle. In common with *Tenthredo,* with which it has considerable affinity, this genus, upon each side of the metathorax, has what Linneus terms "*Granum,*" or a small white spot. In some species the apex of each tibia is armed with a single spine, for instance, *S. Columba,* &c. while in *S. Juvencus,* and others, the posterior are armed with two.

EVANIA. Upon comparing *E. appendigaster* with *E. maculata,* Fab. I am inclined to think that it is a good genus. I suspect that more species than one are confounded under the name of *A. appendigaster.* That figured by Panzer (*c*), with yellow antennæ, and brown feet and abdomen, seems quite distinct from those I have seen, in which these are all black.

AMMOPHILA. The Fabrician character of Sphex seems designed for those insects that I have

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(*c*) Fn. Ins. Germ. Init. n. 68. tab. 12.

called by this name. I find the foreign species to be extremely numerous, some of them are the most splendid insects in the class. My observation, in my paper upon this genus(*d*), that colour seems constant, I find upon a view of the exotic specimens, is not founded in fact, although a considerable proportion are distinguished by the same colours. The antennæ of all are revolute, a circumstance not noticed in that paper.

TIPHIA. This genus, *T. femorata*, at least, and its affinities, is nearly related both to *Scolia* and *Mutilla*. Its eyes are oval and remarkably small; its antennæ are anterior, and spiral with a fusiform apex; its truncus is retuse at both ends, and nearly cubical, and its collum is larger than the thorax. Some of the *Tiphiæ* in Sir Joseph Banks's collection, which, if my recollection does not mislead me, were labelled by Fabricius, belong to a separate genus, intermediate between *Vespa* and *Bembex*. Their tongue, and wings seem to come near the former genus, and their large oval eyes, and conic abdomen, to the latter, but they have not the conic inflected labium, which is its most striking distinction. Christius has figured one of these under the name of *Vespa biclypeata*(*e*). *T. collaris* of Fabricius has reniform eyes, and is a true *Scolia*. *T. pedestris* of the same author, if I do not mistake his insect, seems rather to belong to *Mutilla*; it is

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(*d*) Lin. Trans. vol. 4. p. 200.

(*e*) Hymenopt. p. 223. tab. 19. fig. 6.

apterous, and has no stemmata; its body is, however, without hairs, in which it departs from both genera; it is probably one of the links which connect these proximate genera.

SCOLIA. This genus, at first sight, has a very strong resemblance to *Tiphia*, and also to *Mutilla.* The body is usually very hairy, the truncus retuse before and behind, and rather cubical, but it is distinguished from both by the following circumstances; its eyes are larger and reniform: its antennæ are inserted in the middle of the face, they are recurve, but not at all spiral; their apex sometimes is slightly fusiform, but more generally atteenuate only at its base; its summit is often very obtuse, or rather truncate. The body of these insects is usually very hairy, and the anus is not seldom spinose.

THYNNUS. No genus in the class seems to be less known than this. There is no specimen of it in the French cabinets. Fabricius described his four species from insects in Sir Joseph Banks's collection, of these, two, viz. *T. dentatus* (*f*) and *T. emarginatus*, are certainly congenerous insects, *T. integer* is doubtful, and *T. abdominalis* is an *Apis* of my family "labio inflexo elongato", of the section "ventre femineo glabro", and of the subdivision "abdomine femineo subcylindrico, ano obtuso." Of the two genuine *Thynni*, the antennæ are filiform, of fourteen joints, inserted in the middle of the face:

(*f*) Rœmer. Gen. Ins. tab. 35. fig. 8.

face: the lip is very minute: the maxillæ are bifid at their apex: the eyes are lateral, inclining to an oval figure: the collum is transverse before, and behind subrepand: the thorax is subquadrate: the scutellum, which is as large or larger than the thorax, is triangular, and terminates in a second piece besides the metathorax, so that it may be defined by the term duplex: the abdomen is elongato-conic, and the anus is spinose. In habit it approaches *Bembex*.

Thynnus integer varies from the others in the following particulars. The maxillæ are entire at their apex: the eyes are rather round: the collum receives the head and thorax into a sinus, which is the segment of a circle: the scutellum is single, (simplex) with a truncate apex: the abdomen is subulato-conic, and the ventral segment of the anus terminates in a recurve spine.

DORYLUS. The only species of this genus known as yet, is the *Mutilla helvola*, Lin. which is certainly no *Mutilla*, and cannot well be arranged under any known genus: Fabricius has therefore, with great propriety, placed it by itself. In my idea it is more nearly related to *Formica* than *Mutilla*, for its abdomen is connected with the truncus by the intervention of a globose petiolus. It is a most singular insect; the following are its most prominent features. Its maxillæ are acute, without teeth, forcipate, immensely large: its eyes are hemispherical: its antennæ are filiform, inserted in the middle of the face, and consist of thirteen or fourteen joints: its stemmata are very large and prominent: its face behind the antennæ swells into two protuberances: its thorax is extremely gibbous: and overhangs the head: its scutellum is large and gibbous: the base of its wings is not defended by squamulæ: its legs are very short; the second joint of their apophyses is of a very singular shape, being concavo-convex, very thin, and emarginate at its apex; the thighs are compressed, very flat and thin, and the tibiæ and tarsi short and slender: the abdomen is elongate: the spiracula, which is remarkable, are easily discovered in its dorsal segments, and the last ventral segment terminates in two truncate setæ, like some of the *Neuroptera*, with which class this insect seems to have some affinity. If *Termes* was placed at the end of that class, and *Dorylus* at the head of this, I think we should not depart far from the order of Nature. I know not whether the neuter of *Dorylus* be apterous or not, but I suspect it may.

MUTILLA. The Linnean *Artificial Character* of this genus is very insufficient. One drawn up in the following terms would apply well, at least to all the species that I have had an opportunity of examining.

Os proboscide brevi, palpis setaceis:
Antennæ anteriores, spirales, articulis 13—14, apice fusiformi:
Oculi minuti, subrotundi, laterales:
Alæ et *Stemmata* neutris nulla:
Aculeus reconditus.

I have omitted the Linnean character, " thorax posticè retusus," because it is not by any means peculiar to this genus, and the above seem fully sufficient without it. *T. pedestris*, Fab. I just now observed, belongs to this genus; more of the same habit may be seen in Mr. Francillon's rich cabinet, these are all "corpore glaberrimo;" the shape of their abdomen is similar to that of *Formica*, and they seem to be intermediate between that genus and the hirsute *Mutillæ*. The latter genus, if these prove at last genuine *Mutillæ*, might be divided into two families, *. corpore glabro. **. corpore pubescenti. I have examined only one male insect of this genus, *M. Europæa*. It varies from the female in the shape of its eyes, which are somewhat reniform, and its anus has a minute spine on each side, circumstances which give it considerable affinity with *Scolia*, and shew how the genera shade one into another. Its squamulæ likewise are very large, and its neck embraces the anterior part of the thorax.

TABULARUM EXPLICATIO.

TABULA PRIMA(*a*).

MELITTA, *. a.

FIG. 1. *CAPUT* subtriangulare. *a. Stemmata* in lineâ curvâ.

2. *Proboscis. a a. Valvulæ* linguam amplectentes. *b b. Palpi* exteriores. *c. Lingua* apice biloba lobis divaricatis.

3. *Lingua* valde aucta. *a. Tubus* conicus, apice tridentatus, *b b. Palpi* interiores, setacei, quatuor articulorum. *c.* Linguæ *Apex* ciliatus, lobis apice laceris.

4. *Valvula* valde aucta, sublinearis. *a.* Valvulæ *Basis. b c.* Valvulæ *Apex* plicatus, rotundatus. *b. Plica* inferior. *c. Plica* superior. *d. Palpus* exterior, setaceus, sexarticulatus. *e e. Setæ* rigidiusculæ.

5. *Maxilla* aculeatæ, subedentula.

6. *a. Labium* antice obtusangulum. *b. Faciei* portio antica cui Labium annectitur.

(*a*) N.B. In sequentibus tabulis figuræ omnes sunt plùs minùs auctæ.

FIG.

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FIG. 5. *Maxilla* aculeatæ, apice bidentata dente interiori subemarginato.

6. *Maxilla* maris, apice bidentata dente interiori integro.

7. *Ala superior*. *a*. *Basis*. *b*. *Medium* areolis sex. *c*. *Apex*. *d*. *Nervus costalis* exterior. *e*. *Nervus costalis* interior. *f*. *Anastomosis*.

8. Portio Antennæ *M. dilatatæ* mas, (vol. 2. p. 39) *a*. *Scapus* dilatatus, patelliformis.

9. *Antenna* aculeatæ, apicis articulo primo pedicelloque subconicis.

10. *Antenna* maris.

11. *Abdomen* aculeatæ subconicum, basi retusum, segmentis sex.

12. *Abdomen* masculum septem segmentorum.

TABULA SECUNDA.

MELITTA. **. a.

FIG. 1. *Proboscis* valde aucta. *a*. *Tubus* conicus, apice obsoletè tridentatus. *b b*. *Valvulæ*. *c*. *Linguæ* apex, acutus vel acuminatus. *d d*. *Auriculæ* apice laceræ. *e e*. *Lora*. *f*. *Membrana* lora connectens. *g g*. *Palpi* interiores fractæ, articulis 4, articulo primo longiore arcuato.

2. *Valvula* linearis. *a*. *Palpus exterior* sex articulorum. *b*. Valvulæ *Basis*. *c*. Valvulæ

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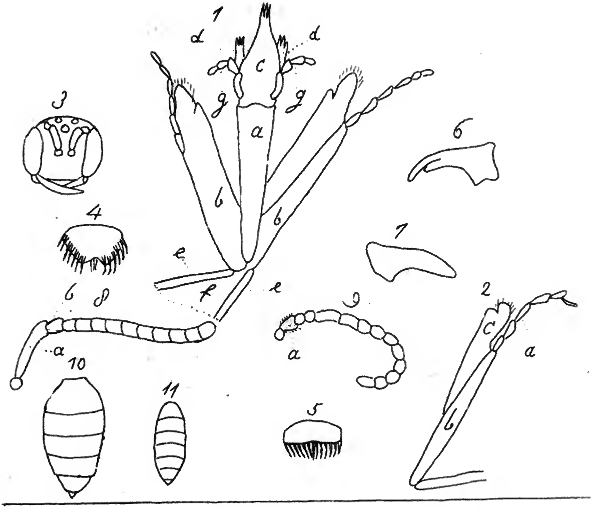
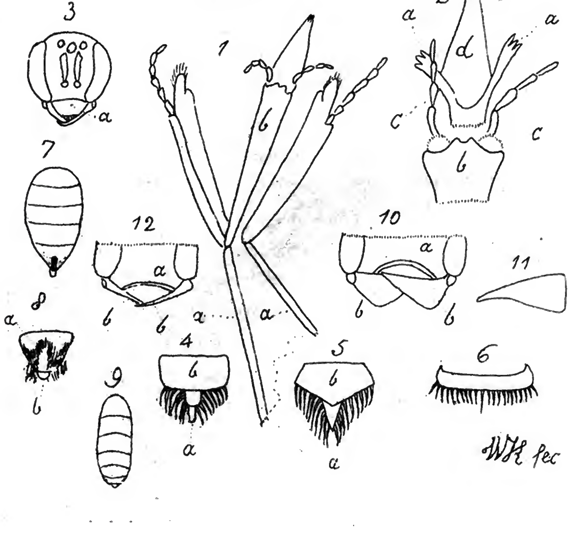
Melitta Tab. 2

* * . a.



* * b.



WK fec

Valvulæ *Apex* brevis, rotundatus, hinc intus fissus.

FIG. 3. *Caput* rotundatum.

4. *Labium* aculeatæ valde auctum, anticè emarginatum, setoso-pectinatum.
5. *Labium* masculum valde auctum, anticè subemarginatum.
6. *Maxilla* aculeatæ, apice bidentata dente exteriori longiore.
7. *Maxilla* mascula, apice edentula.
8. *Antenna* aculeatæ, subclavatæ. *a. Scapus* elongatus. *b. Pedicellus* subglobosus.
9. *Antenna* maris, filiformis, submoniliformis. *a. Scapus* brevis.
10. *Abdomen* aculeatæ, ovatum, sex segmentorum, ultimo minutissimo.
11. *Abdomen* masculum sublineare, septem segmentorum.

MELITTA. **. b.

FIG. 1. *Proboscis. a a. Lora* proboscidis longitudine. *b. Tubus* conicus.

2. *Lingua* valde aucta. *a a. Auriculæ* apice laceræ. *b. Tubi* portio apice tridentato, dente intermedio emarginato. *c c. Palpi* interiores fractæ, articulis quatuor, primo longiori arcuato. *d.* Linguæ *Apex* acutus, lacerus.
3. *Caput* subtriangulare. *a. Nasus.*

FIG. 4. *Labium* aculeatæ valde auctum, anticè appendiculatum, et setoso-pectinatum. *a. Appendicula. b. Labium.*

5. *Labium* aliud figurâ diversum.

6. *Labium* masculum, valde auctum, lineare, absque appendiculâ.

7. *Abdomen* aculeatæ subovale, sex segmentorum, ultimo minutissimo.

8. *Anus* aculeatæ valde auctus. *a. Rima* analis. *b.* Abdominis segmentum ultimum.

9. *Abdomen* masculum, lineare, septem segmentorum.

10. Anterior pars capitis *M. quadricinctæ* mas, (tom. 2. p. 51.) *a. Labium. bb. Maxillæ* basi dilatatæ.

11. *Maxilla* ejusdem seorsum conspecta.

12. Anterior pars capitis *M. rubicundæ* mas, (tom. 2. p. 53.) *a. Labium. bb. Maxillæ.*

TABULA TERTIA.

MELITTA. **. b. cont.

FIG. 1. *Caput* a latere conspectum ad modum exhibendum proboscidem explicandi. *a. Lora. b. Proboscis* apice maxillas versus.

2. *Valvula* valde aucta, linearis. *a. Palpus* exterior, setaceus, sex articulorum. *b. Lorum* valde elongatum. *c.* Valvulæ *Basis.*

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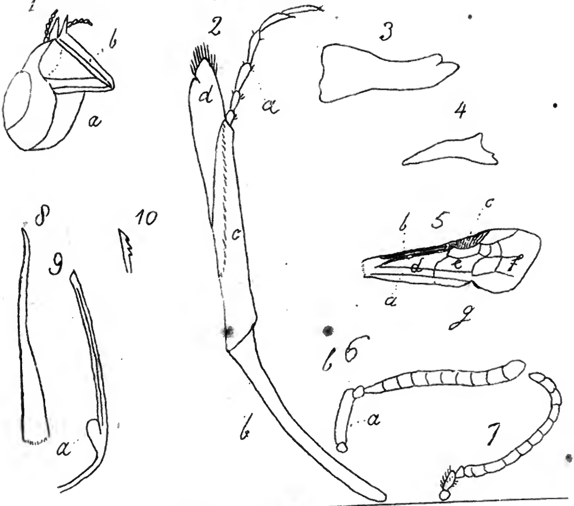
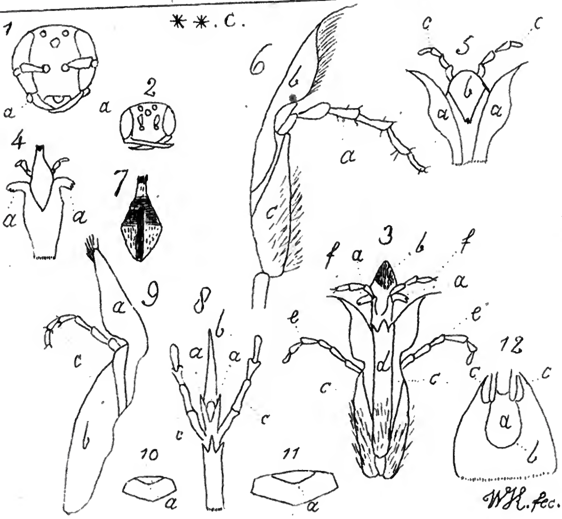
Tab. 3.

Melitta

**. b. cont.



**. c.



WK. fec.

Basis. *d. Apex* obtusus, intus hinc fissus.

FIG. 3. *Maxilla* aculeatæ, apice bidentata.

4. *Maxilla* mascula, arcuata, apice edentula, acuta.

5. *Ala superior.* *a b. Nervi* costales. *c. Anastomosis.* *d. Basis* alæ. *e. Medium* areolis septem. *f. Apex.* *g.* Concursus apicis et basis alæ.

6. *Antenna* aculeatæ, subclavata. *a. Scapus* elongatus. *b. Pedicellus* subglobosus.

7. *Antenna* maris, filiformis, scapo brevi, apice articulis subarcuatis.

8. Aculei *Vagina* subulata.

9. *Spiculum.* *a. Retinaculum.*

10. *Spiculi* apex hinc retrorsum serrulatus.

MELITTA. **. c.

FIG. 1. *Caput* subrotundatum. *a a. Tubercula* apud basin Maxillarum.

2. *Caput* masculum, maxillis forcipatis.

3. *Proboscis* basi subtus villosa. *a a. Auriculæ.* *b.* Linguæ apex acutus. *c c. Valvulæ.* *d. Tubus* linearis, apice tridentatus. *e e. Palpi* exteriores. *f f. Palpi* interiores.

4. *Lingua* valde aucta, apice hastata. *a a Auriculæ* recurvæ, apice laceræ.

5. Linguæ plicatæ positionem exhibet. *a a.*

Valvularum *Apex*. *b*. Linguæ apex sursum plicatus, acumine gulam versus. *cc. Palpi* interiores.

FIG. 6. *Valvula* valde aucta. *a. Palpus* exterior, setaceus, sex articulorum. *b*. Valvulæ *Apex* semi-cordatus, acuminatus. *c. Basis* villosus.

7. Linguæ *Apex* valde auctus, seorsum conspectus, acuminatus acumine lacero, rimâ longitudinali, dimidiato-transversè-striatus.

8. *Lingua M. Swammerdamellæ* (tom. 2. p. 174.) *aa. Auriculæ* acutæ. *b*. Linguæ *Apex* subsetaceus. *cc. Palpi* interiores.

9. *Valvula* ejusdem valde aucta. *a. Apex* cultriformis. *b. Basis*. *c. Palpus* exterior.

10. *Labium* maris. *a. Tuberculum.*

11. *Labium* aculeatæ. *a. Tuberculum.*

12. *Capitis* pagina inferior. *a. Gula*. *b. Annulus*. *cc*. Valvularum *Basis*.

TABULA QUARTA.

MELITTA. **. c. cont.

FIG. 1. *Abdomen* aculeatæ, ovale, sex segmentorum ultimo minutissimo. *a. Fimbria* anum vestiens.

2. *Abdomen* masculum sublanceolatum, septem segmentorum.

FIG.

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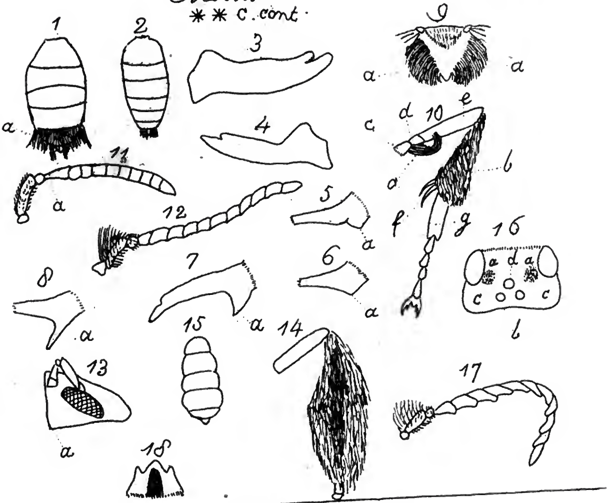
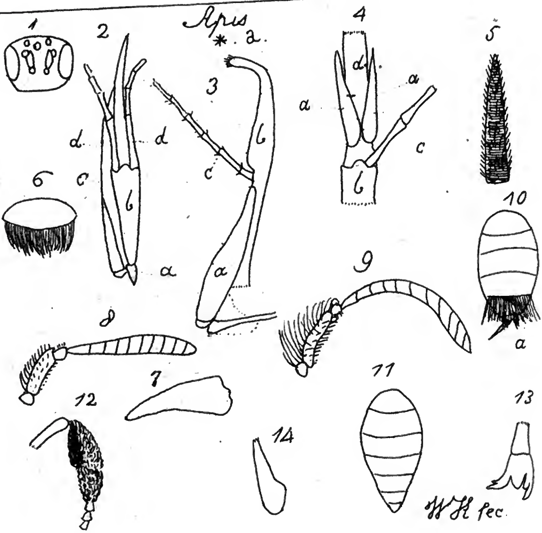
Melitta
** c. cont.



Apis
*. a.



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3. *Maxilla* aculeatæ, apice bidentata.
4. *Maxilla* maris.
5. *Maxillæ* pars *M. denticulatæ* (tom. 2. p. 133.) *a. Denticulus* basin maxillæ armans.
6. *Maxillæ M. angulosæ* (tom. 2. p. 127.) portio. *a*. Basis obtusangula.
7. *Maxilla M. armatæ* (tom. 2. p. 124.) *a. Dens* basin armans.
8. *Maxillæ M. spinigeræ* (tom. 2. p. 123.) portio. *a. Spina* basin armans.
9. *Metathorax M. combinatæ* (tom. 2. p. 153.) utrinque fimbriata. *a a. Fimbria.*
10. Pes posticus. *a. Flocculus. b. Scopa. c. Apophysis* articulus primus. *d. Apophysis* articulus secundus. *e. Femur. f. Spinulæ. g. Planta.*
11. *Antenna* aculeatæ. *a.* Apicis articulus primus elongatus, basi attenuatus.
12. *Antenna* maris scapo villosissimo.
13. *Caput M. angulosæ* (tom. 2. p. 127.) a latere conspectum. *a. Gena* postice rectangula.
14. *Pes posticus M. Swammerdamellæ* (tom. 2. p. 174.)
15. *Abdomen M. Shawellæ* (tom 2. p. 160.)
16. *Capitis* portio. *a a.* Maculæ duæ sericeæ apud oculos. *b. Occiput. c c. Vertex. d. Stemmata.*
17. *Antenna* maris *M. chrysuræ.* (tom. 2. p. 172.) apice subtus subdentato.

FIG. 18. *Labium M. tridentatæ* (tom. 2. p. 132.) a ventre conspectum.

APIS. *. a.

FIG. 1. Maris *Caput* anticè truncatum.

2. *Proboscis. a. Fulcrum. b. Tubus* conicus, apice tridentatus. *c. Valvula* linearis. *dd. Palpi* interiores quatuor articulorum, primo elongato. *e. Lingua* setacea.

3. *Valvula* valde aucta, linearis. *a. Basis. b. Apex* lanceolato-linearis, incurvus. *c. Palpus* exterior subsetaceus, sex articulorum.

4. *Linguæ* portio valde aucta. *aa. Laciniæ* interiores lineari-lanceolatæ, acutæ. *b. Tubi* pars. *c. Palpi* interioris pars. *d. Linguæ* pars.

5. Linguæ *Apex* valde aucta, villosa, transversè striatula.

6. *Labium* valde auctum, subovale, anticè barbatum.

7. *Maxilla* edentula.

8. *Antenna* aculeatæ.

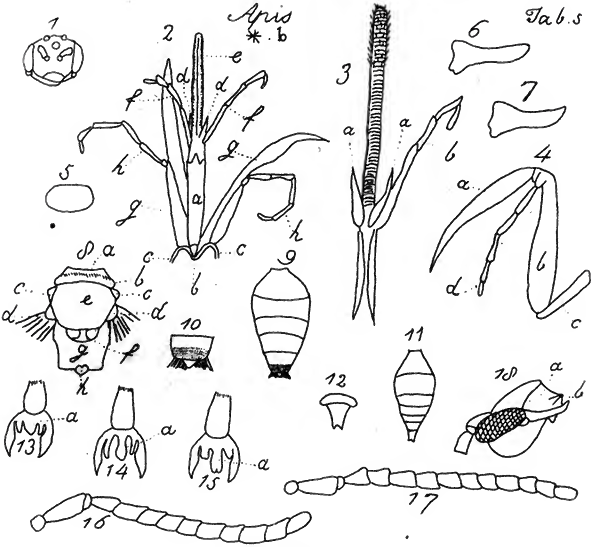
9. *Antenna* maris.

10. *Abdomen* aculeatæ, ovale, sex articulorum, ultimo minutissimo. *a.* Ani *Fimbria.*

11. *Abdomen* maris, ovato-lanceolatum.

12. *Pes posticus A. ursinæ* (tom. 2. p. 178.)

FIG.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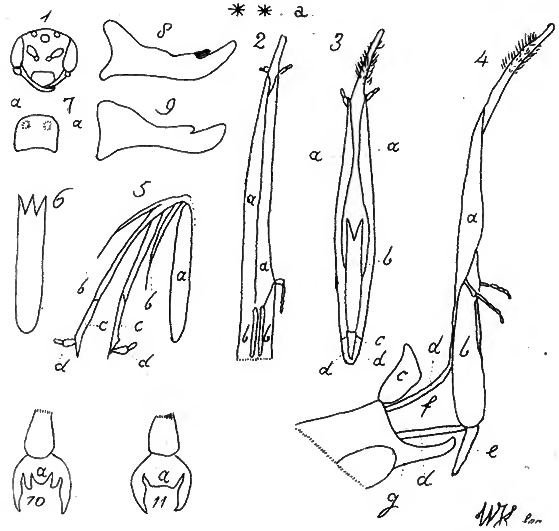
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FIG. 13. *Unguis* unguiculis bifidis.

14. *Tibia* postica *A. Linnæellæ* (ubi supr. 179.) dolabriformis.

TABULA QUINTA.

APIS. * b.

FIG. 1. *Caput* posticè obtusangulum.

2. *Proboscis*. *a. Tubus* linearis, apice tridentatus, dente intermedio majori. *b. Fulcrum* subtriangulare. *cc. Lora*. *dd. Laciniæ* interiores. *e. Lingua*. *ff. Palpi* interiores. *gg. Valvulæ*. *hh. Palpi* exteriores.

3. *Lingua* valde aucta. *aa. Laciniæ* interiores subsetaceæ. *b. Palpi* interiores quatuor articulorum primo elongato.

4. *Valvula* valde aucta, sublinearis. *a. Apex* lanceolato-linearis. *b. Basis*. *c. Lorum*. *d Palpus* exterior sex articulorum, primo brevissimo.

5. *Labium* ovale.

6. *Maxilla* maris.

7. *Maxilla* aculeatæ.

8. *Truncus*. *a Collum*. *b. Collare*. *cc. Tubercula*. *dd. Squamulæ*. *e. Thorax*. *f. Scutellum*. *g. Metathorax*. *h. Cavitas* ubi inosculatur abdominis petiolus.

9. *Abdomen* aculeatæ, sex segmentorum, ultimo minutissimo.

10. *Anus* valde auctus, apice setosus.

FIG. 11. *Abdomen* maris, lanceolatum, septem segmentorum

12. *Anus* valde auctus, apice emarginatus.

13. *Unguis* aculeatæ valde auctus. *a. Pulvillus.*

14. *Unguis* alius valde auctus. *a. Pulvillus* petiolatus.

15. *Unguis* maris valde auctus. *a. Pulvillus* elongatus.

16. *Antenna* aculeatæ.

17. *Antenna* maris.

18. *Caput A. corrnigeræ* (tom. 2. p. 190) a latere conspectum. *a. Labium. b. Cornu.*

APIS. **. a.

FIG. 1. *Caput* posticè obtusangulum.

2. *Proboscidis* pars inferior, valvulis linguam obvolventibus. *aa.* Valvularum *Apex. bb. Basis.*

3. *Proboscidis* pars superior. *aa.* Valvularum *Apex. b. Tubus. c. Fulcrum. dd. Lora.*

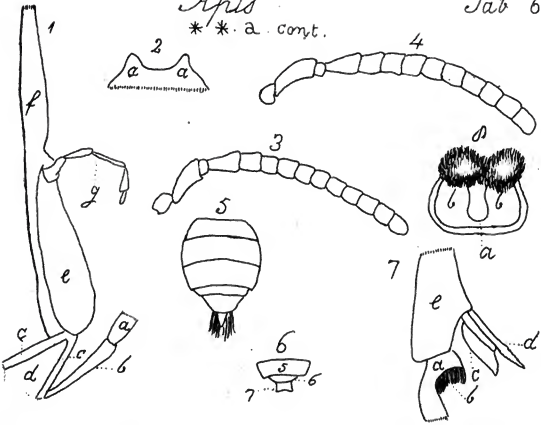
4. *Proboscis* a latere conspecta. *a.* Valvulæ *Apex. b. Basis. c. Labium. dd. Lora. e. Fulcrum. f. Membrana* lora connectens. *g. Maxilla.*

Obs. *Hæ tres ultimæ figuræ linguam valvulis munitam et convolutam exhibent.*

5. *Proboscidis* portio. *a Tubus* a latere conspectus. *bb. Laciniæ* interiores setaceæ.

Apis Tab 6

* * . a . cont.



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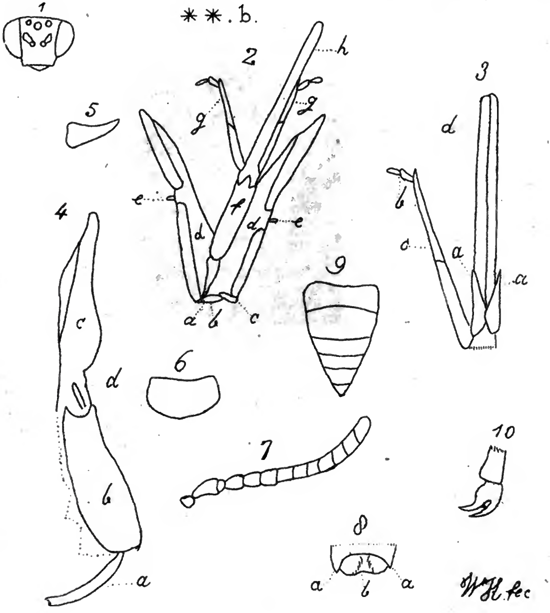

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setaceæ. *cc. Laciniæ* exteriores. *dd. Palpi* interiores biarticulati.

FIG. 6. *Tubus* linearis, apice tridentatus dentibus æqualibus.

7. *Labium* valde auctum, subquadratum, concavo-convexum. *aa. Puncta* duo fenestrata.

8. *Maxilla* aculeatæ.

9. *Maxilla* maris.

10. *Unguis* maris valde auctus, unguiculis bifidis, dentibus intermediis membranaceis. *a. Pulvillus* integer.

11. *Unguis* aculeatæ unguiculis integris. *a. Pulvillus* emarginatus.

TABULA SEXTA.

APIS. **. a. cont.

FIG. 1. *Valvula* valde aucta. *a. Tubi* basis. *b. Fulcrum* elongatum. *cc. Lora. d. Membrana* lora connectens. *e.* Valvulæ *Basis. f. Apex. g. Palpus* exterior filiformis, quinque articulorum, articulo intermedio attenuato.

2. *Scutelli* pars. *aa. Dentes* sub hirsutie ocultati.

3. *Antenna* maris, quatuordecim articulorum.

4. *Antenna* aculeatæ, tredecim articulorum.

5. *Abdomen* aculeatæ, ex ovato subglobosum, ano mucronato.

FIG. 6. *Anus* maris, segmento ultimo subemarginato.

7. Portio *Pedis* antici valde aucta. *a.* Pars *Palmæ* segmento circuli dempto. *b.* *Strigilis* *f.* pecten setarum *c.* *Velum.* *d.* *Spinulæ* utrinque serrulatæ. *e.* *Tibiæ* portio.

8. *a.* *Sternum.* *bb.* *Pectus.*

APIS. **. b.

FIG. 1. *Caput.*

2. *Proboscis.* *a.* *Fulcrum* elongatum, subclavatum. *b.* *Lori* pars. *c.* Valvulæ *Cardo.* *dd.* *Valvulæ.* *ee.* *Palpi* exteriores. *f.* *Tubus* linearis, apice tridentatus dente interiori majore. *gg.* *Laciniæ* exteriores. *h.* *Lingua.*

3. *Lingua* valde aucta. *aa.* *Laciniæ* interiores, lineari-lanceolatæ. *b.* *Palpus* interior biarticulatus. *c.* *Lacinia* exterior e duobus æqualibus articulis constans.

4. *Valvula* valde aucta, linearis. *a.* *Lorum.* *b.* Valvulæ *Basis.* *c.* Valvulæ *Apex* lanceolatus, obtusus. *d.* *Palpus* exterior minutissimus, exarticulatus.

5. *Maxilla* apice acuta, edentula.

6. *Labium* anticè curvum, *f.* subarcuatum.

7. *Antennæ* aculeatæ tredecim articulorum.

8. *Trunci* portio. *aa.* *Dentes* thoracem posticè armans. *b.* *Scutellum* tuberculis duobus munitum.

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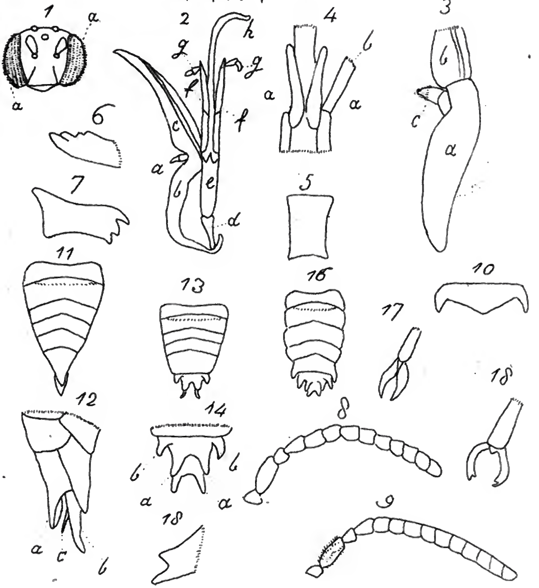
Apis

Tab. 7

**.C 1.α



**.C 1.β

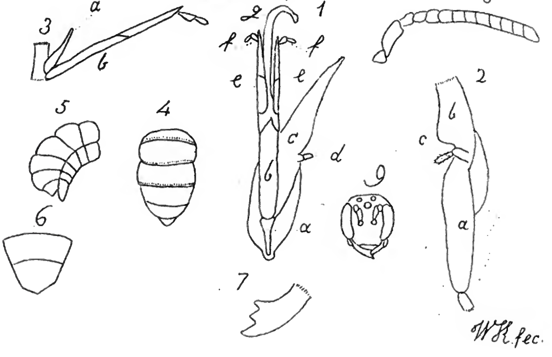


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FIG. 9. *Abdomen* aculeatæ conicum, sex segmentorum.

10. *Unguis* unguiculis integris.

TABULA SEPTIMA.

APIS. **. c. 1. α.

FIG. 1. *Caput.* *a a. Oculi* pilosissimi.

2. *Proboscis* *a. Palpus* exterior. *b.* Valvulæ *Basis.* *c. Apex.* *d. Fulcrum.* *e. Tubus* linearis, apice tridentatus, dente intermedio longiori. *ff. Laciniæ* exteriores. *gg. Palpi* interiores biarticulati *h. Lingua.*

3. *Valvulæ* portio valde aucta. *a. Basis.* *b. Apex.* *c. Palpus* exterior, biarticulatus, acutus, pilosulus.

4. *Proboscidis* portio valde aucta. *a a. Laciniæ* interiores, lineares. *b. Lacinia* exterior.

5. *Labium.*

6. *Maxilla* aculeatæ.

7. *Maxilla* maris.

8. *Antenna* aculeatæ tredecim articulorum.

9. *Antenna* maris quatuordecim articulorum.

10. *Scutellum A. conicæ* (tom. 2. p. 224.) dente incurvo utrinque.

11. *Abdomen* aculeatæ.

12. *Anus* dehiscens a latere conspectus. *a.* Segmentum ultimum tergi. *b.* Segmentum ultimam ventris. *c. Aculeus.*

FIG. 13. *Abdomen* maris.
- 14. *Anus* a dorso conspectus. *a a. Dentes* furcati terminales. *b b. Dentes* laterales integri.
- 18. *Dens* terminalis furcatus a latere conspectus.
- 16. *Abdomen* masculum *A. inermis* (tom. 2. p. 229) ano octodentato.
- 17. *Unguis* aculeatæ, unguiculis integris.
- 18. *Unguis* maris, unguiculis apice bifidis.

APIS. **. c. 1. β.

FIG. 1. *Proboscis. a. Fulcrum* elongatum, subclavatum. *b. Tubus* linearis. *c. Valvula. d. Palpus* exterior. *e e. Laciniæ* exteriores. *f f. Palpi* interiores. *g. Lingua.*
- 2. *Valvulæ* portio valde aucta. *a.* Valvulæ *Basis. b. Apex. c. Palpus* exterior biarticulatus.
- 3. *Proboscidis* portio. *a. Lacinia* interior brevis, setaceus. *b. Lacinia* exterior.
- 4. *Abdomen* aculeatæ, incurvum.
- 5. Idem a latere conspectum. *a. Anus* subdehiscens.
- 6. *Anus* rectangulus *A. phæopteræ* (tom. 2. p. 232)
- 7. *Maxilla* aculeatæ apice tridentata.
- 8. *Antenna* aculeatæ tredecim articulorum.
- 9. *Caput* rotundatum.

TABULA

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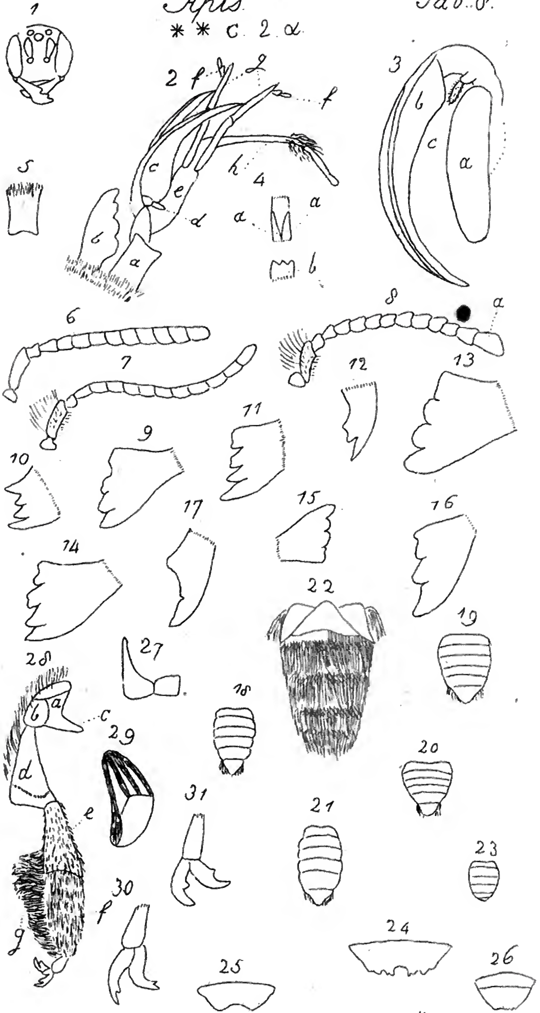
Apis

* * C. 2. α.

Tab. 8.



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TABULA OCTAVA.

APIS. **. c. 2. *α*.

FIG. 1. *Caput* rotundatum, maxillis prominentibus, validissimis.

2. *Proboscis.* *a. Labium.* *b. Maxilla.* *c. Valvula.* *d. Palpus* exterior. *e. Tubus.* *ff. Palpi* interiores. *g. Laciniæ* exteriores. *h. Lingua.*

3. *Valvula* valde aucta. *a. Basis.* *b. Apex.* *c. Palpus* biarticulatus.

4. Portio *Proboscidis.* *aa. Laciniæ* interiores, breves, acutæ. *b. Tubi* portio, apice tridentato dentibus æqualibus.

5. *Labium.*

6. *Antenna* aculeatæ, tredecim articulorum.

7. *Antenna* maris quatuordecim articulorum.

8. *Antenna* mascula *A. Willughbiellæ* (tom. 2. p. 233, 234.) *a.* Articulus extimus reliquis major.

9. *Maxilla* aculeatæ ejusdem (ibid. p. 233.)

10. *Maxilla* maris ejusdem (ibid. p. 234.)

11. *Maxilla* aculeatæ *A. centuncularis* (ibid. p. 239.)

12. *Maxilla* maris ejusdem (ibid. p. 240.)

13. *Maxilla* aculeatæ *A. maritimæ* (ibid. p. 242.)

FIG. 14. *Maxilla* aculeatæ *A. lignisecæ* (ibid. p. 244.)

17. *Maxilla* maris ejusdem apice bidentata, dente interiori brevissimo segmento circuli dempto.

15. *Maxilla* aculeatæ, *A. circumcinctæ* (ibid. p. 246.)

16. *Maxilla* aculeatæ *A. xanthomelanæ* (ibid. p. 247.)

18. *Abdomen* aculeatæ *A. centuncularis* (ibid. p. 239.)

19. *Abdomen* aculeatæ *A. maritimæ* (ibid. p. 242.)

20. *Abdomen* aculeatæ *A Willughbiellæ* (ibid. p. 234.)

21. *Abdomen* aculeatæ *A. lignisecæ* (ibid. p. 244.)

22. *Venter* hirsutie densâ tectus.

23. *Abdomen* masculum.

24. *Anus* masculus *A. Willughbiellæ* (ibid. p. 234.)

25. *Anus* masculus *A. lignisecæ* (ibid. p. 244.)

26. *Anus* masculus *A. centuncularis* (ibid. p. 240.)

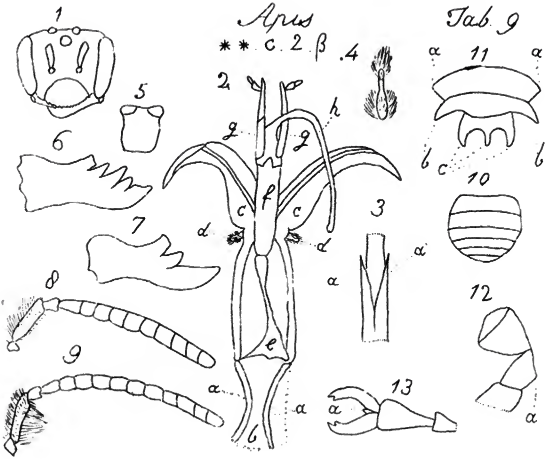
27. *Apophysis* mascula *A. Willughbiellæ* (ibid. p. 234.)

28. *Pes* anticus masculus ejusdem (ibid) *a. Apophysis* articulus primus. *b.* Articulus secundus. *c.* Articuli primi *Mucro.*

Apus

Tab. 9

** c. 2 β



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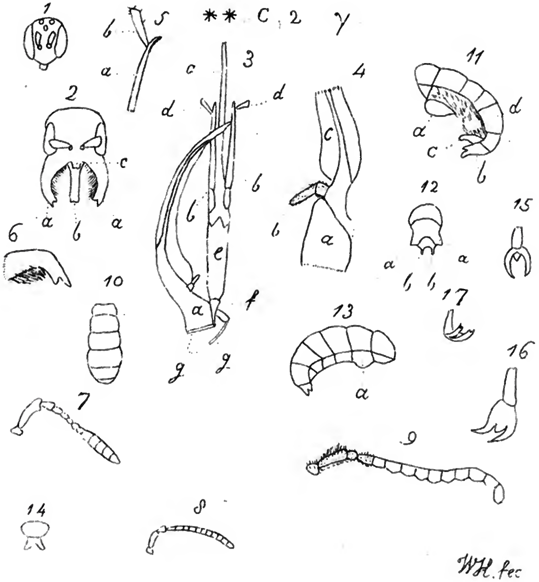

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Mucro. *d.* *Femur.* *e.* *Tibia.* *f.* *Tarsus.* *g.* *Cilia* incurva tarsi.

FIG. 29. *Femur.*

30. Maris *Unguis* unguiculis apice bifidis.

31. Aculeatæ *Unguis* unguiculis hinc dente instructis.

TABULA NONA.

APIS **. c. 2. β.

FIG. 1. *Caput* rotundatum. *a.* *Nasus.*

2. *Proboscis.* *aa.* *Lora.* *b.* *Membrana* lora connectens. *cc.* *Valvulæ.* *dd.* *Palpi* exteriores. *e.* *Fulcrum* elongatum. *f.* *Tubus* linearis. *gg.* *Laciniæ* exteriores. *h.* *Lingua.*

3. *Linguæ* Portio. *aa.* *Laciniæ* interiores lineari-lanceolatæ, acutæ.

4. *Palpus* exterior exarticulatus.

5. *Labium.*

6. *Maxilla* aculeatæ *A.* *manicatæ* (tom. 2. p. 249.)

7. *Maxilla* maris ejusdem (ibid. p. 250.)

8. *Antenna* aculeatæ tredecim articulorum.

9. *Antenna* maris quatuordecim articulorum.

10. *Abdomen* aculeatæ, subglobosum.

11. *Anus* masculus apice spinis quinque armatus. *aa.* Segmentum antepenultimum utrinque in angulum protensum (ibid. p. 250.) *bb.* *Spinæ* segmenti penultimi. *c.* *Spinæ* anales.

FIG. 12. *Apophysis* postica mascula. *a.* Articulus secundus obtusangulus (ibid.)

13. *Unguis* unguiculis apice bifidis. *a.* *Pulvillus* minutissimus.

APIS. **. c. 2. γ.

FIG. 1. *Caput* subglobosum.

2. Caput *A. maxillosæ* (tom. 2. p. 251.) *aa. Maxillæ. b. Labium. c. Squamula* nasi.

3. *Proboscis. a. Valvula. bb Laciniæ* exteriores articulo primo brevi. *c. Lingua. dd. Palpi* interiores. *e. Tubus* linearis, apice tridentatus. *f. Fulcrum. gg. Lora.*

4. *Valvulæ* portio valde auctæ. *a. Basis. b. Palpus* exterior, biarticulatus. *c. Apex.*

5. *a. Laciniæ* exterioris pars. *b. Palpus* interior exarticulatus.

6. *Maxilla* seorsum conspecta.

7. *Antenna* aculeatæ tredecim articulorum, clavata.

8. *Antenna* mascula, quatuordecim articulorum.

9. *Antenna* mascula *A. florisomnis* (ibid. p. 254.) articulis intermediis subtus obtusangulis.

10. *Abdomen* aculeatæ.

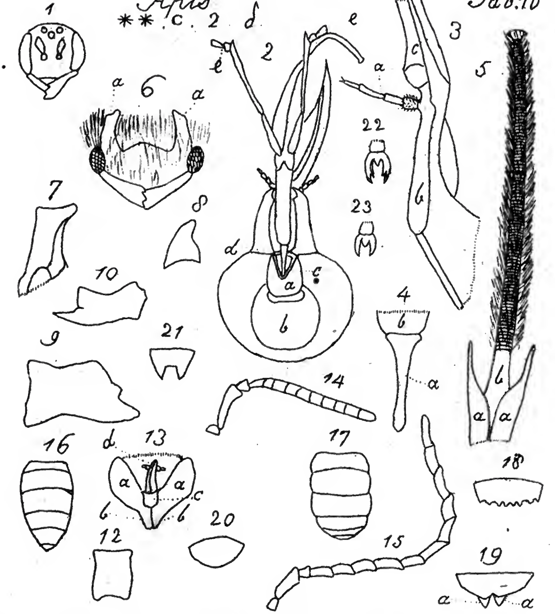
11. *Abdomen* masculum *A. florisomnis* (ibid.) *a. Cornu* ventris. *b. Anus*

apice

Apus

Tab.10

* * .c. 2



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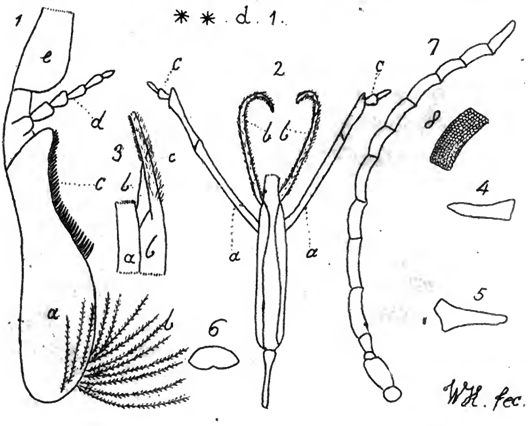

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apice bidentatus. *c. Cornu* ani ventralis, *f.* segmentum ultimum recurvum. *d.* Cavitas tomentoso-pallida.

FIG. 12. *Anus* ejusdem. *a a. Dentes* dorsales ani. *b b. Dentes* ventrales ani.

13. *Abdomen* masculum *A. Campanularum* (ibid. p. 257.) *a. Ventris* segmenti secundi tuberculum.

14. *Anus* ejusdem apice bidentatus dentibus acutis.

15. *Unguis* aculeatæ }
16. *Unguis* maris } unguiculis integris.

17. *Unguis* masculus aliûs speciei, unguiculis bifidis.

TABULA DECIMA.

APIS. **. c. 2. δ.

FIG. 1. *Caput* subglobosum, maxillis prominentibus.

2. *Proboscis* explicata unà cum capite. *a. Gula. b. Jugulum. c. Lora. d. Fulcrum. e e. Palpi* interiores biarticulati.

3. *Valvula* valde aucta. *a. Palpus* exterior quatuor articulorum. *b.* Valvulæ *Basis. c. Apex.*

4. *Tubi* portio valde aucta. *a. Fulcrum* elongatum. *b. Tubi* pars.

5. *Lingua* valde aucta, pilosissima, transversè striatula, apice subcapitata. *aa.*

Laciniæ interiores lanceolatæ, acuminatæ. *b. Lingua.*

FIG. 6. Capitis *A. bicornis* (tom. 2. p. 271.) portio. *a a.* Cornua rigida quæ faciem armant.

7. *Cornu* præcedentis, valde auctum, seorsum conspectum.

8. *Cornu* Var. β (ibid. p. 273) valde auctum.

9. *Maxilla* aculeatæ.

10. *Maxilla* maris.

12. *Labium.*

13. Capitis pars prona ad *Labii* situm exhibendum. *a a. Genæ. b b. Maxillæ. c. Labium. d. Proboscidis* apex.

14. *Antenna* aculeatæ.

15. *Antenna* maris.

16. *Abdomen* aculeatæ.

17. *Abdomen* masculum.

18. *Anus* masculus *A. spinulosæ* (ibid. p. 262.)

19. *Anus* masculus *A. cærulescentis* (ibid. p. 266.) *a a. Dentes* ani ventrales.

20. *Anus* masculus *A. bicornis* (ibid. p. 273.)

21. Segmentum ultimum ventrale maris *A. Timensis* (ibid. p. 270.)

22. *Unguis* maris unguiculis bifidis.

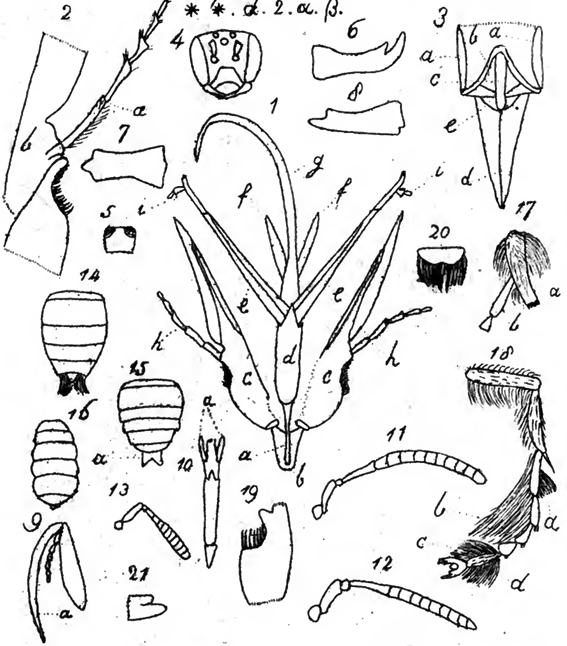
23. *Unguis* aculeatæ unguiculis integris.

APIS. **. d. 1.

FIG. 1. *Valvulæ* portio valde auctæ. *a.* Valvulæ *Basis. b. Pili* plumosi. *c. Pecten. d. Palpus*

Tab. 11

Apis. ✱✱. d. 2. α. β.



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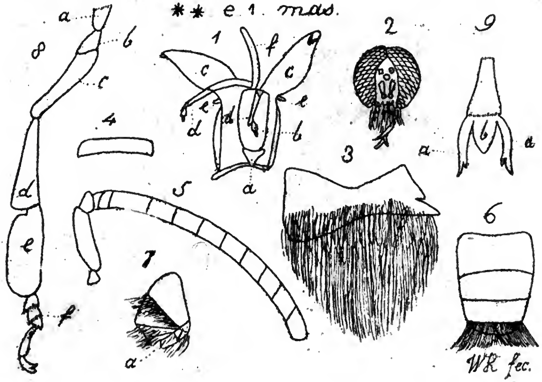

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d. Palpus exterior sexarticulatus. *e.* Valvulæ *Apex*.

FIG. 2. *Proboscidis* portio. *aa. Laciniæ* exteriores. *bb. Laciniæ* interiores pilosæ apicibus involutis. *cc. Palpi* interiores biarticulati.

3. *Linguæ* portio et *Laciniæ* interiores valde aucta. *a. Lingua*. *bb. Basis* laciniæ interioris linguam vaginans. *c. Cilia*.

4. *Maxilla* maris.

5. *Maxilla* aculeatæ.

6. *Labium* anticè emarginatum.

7. *Antenna* maris elongata articulis arcuatis.

8. *Antennæ* articulus valde auctus ex hexagonis innumeris constans.

TABULA UNDECIMA.

APIS. **. d. 2. α. β.

FIG. 1. *Proboscis* explicata. *a. Fulcrum*. *b. Lora*. *c. Valvulæ*. *d. Tubus*. *ee. Laciniæ* exteriores. *ff. Laciniæ* interiores. *g. Lingua*. *hh. Palpi* exteriores. *ii. Palpi* interiores.

2. *Valvulæ* portio valde aucta. *a. Palpus* exterior, sex articulorum. *b. Valvula*.

3. *Proboscis* plicata extracta, ut interiora ejus in situ naturali exhibeantur. *aa. Basis* Valvularum. *b. Lora*. *c. Fulcrum*. *d.* Valvularum *Apex*. *e. Tubus*.

FIG. 4. *Caput.* *a. Nasus.*

5. *Labium* quadratum.

6. *Maxilla* aculeatæ.

7. *Maxilla* aculeatæ *A. furcatæ* (tom. 2. p. 288.)

8. *Maxilla* maris.

9. *Valvula A cyaneæ* (tom. 2. p. 308.) *a. Apex* incurvus.

10. *Proboscidis* ejusdem pars. *a. Laciniæ* interiores.

11. *Antenna* maris.

12. *Antenna* aculeatæ.

13. *Antenna* aculeatæ *A. cyaneæ.*

14. *Abdomen* aculeatæ.

15. *Abdomen* masculum *A. furcatæ* (tom. 2. ubi supr.) *a.* Furca ani.

16. *Abdomen* aculeatæ *A. cyaneæ* (ubi supr. p. 309.)

17. *Pedis* postici pars. *a. Tibia.* *b. Tarsus* infra apicem tibiæ insertus.

18. *Pes* intermedius maris *A. retusæ* (ubi supr. p. 299.) *abcd.* Barba tarsi.

19. Valvulæ *Basis A. violaceæ,* Lin. *a. Pecten.*

20. *Labium* ejusdem anticè emarginatum.

21. *Maxillæ* ejusdem apex.

APIS. **. e. 1. mas.

FIG. 1. *Proboscis.* *a. Fulcrum.* *b. Tubus.* *cc. Valvulæ.* *dd. Laciniæ* interiores. *ee. Palpi* exteriores. *f. Lingua.*

FIG.

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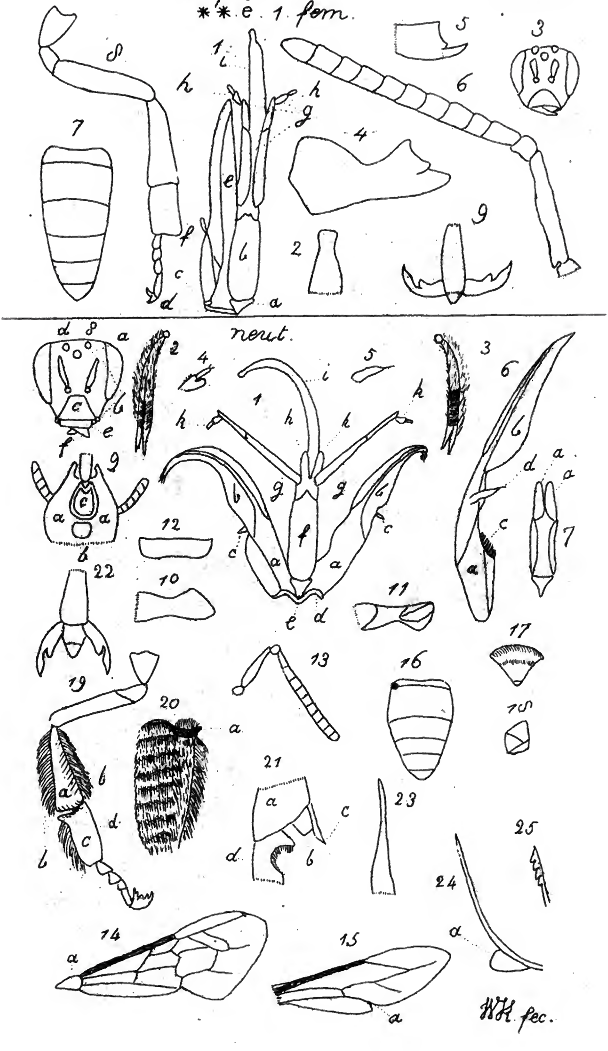
Apis

Tab. 12



W.H. fec.

FIG. 2. *Caput* oculis posticè concurrentibus.

3. *Maxilla* valde aucta, apice bidentata, dente interiore truncato.

4. *Labium*.

5. *Antenna* valde aucta, apice articulis duobus primis brevissimis.

6. *Abdomen*.

7. *Anus* a latere conspectus.

8. *Pes* pósticus. *ab*. *Apophysis*. *c*. *Femur*. *d*. *Tibia*. *e*. *Planta*. *f*. *Digitus*.

9. *Unguis*. *aa*. *Unguiculi*. *b*. *Pulvillus*.

TABULA DUODECIMA.

APIS. **. e. 1. fem.

FIG. 1. *Proboscis*. *a*. *Fulcrum*. *b*. *Tubus* dente intermedio emarginato. *c*. *Cardo*. *d*. *Lorum*. *e*. *Valvula*: *f*. *Palpus* exterior. *g*. *Laciniæ* exteriores. *hh*. *Palpi* interiores. *i*. *Lingua*.

2. *Linguæ* apex constrictus.

3. *Caput*.

4. *Maxilla* valde aucta, apice bidentata, dente interiore segmento circuli dempto.

5 Eadem in situ diverso conspecta.

6. *Antenna* valde aucta.

7. *Abdomen* elongato-conicum.

8. *Pes* posticus.

9. *Unguis* valde auctus.

APIS. **. e. 1. neut.

FIG. 1. *Proboscis* explicata. *aa*. Valvularum *Basis*. *bb*. *Apex*. *cc*. *Palpi* exteriores.

ores. *d. Lora.* *e. Fulcrum.* *f. Tubus.* *g g. Laciniæ* exteriores. *h h. Laciniæ* interiores. *i. Lingua.* *k k. Palpi* interiores.

2. *Linguæ* pagina inferior.
3. *Linguæ* pagina superior.
4. *Palpus* interior valde auctus, articulo primo bifido.
5. *Palpus* exterior valde auctus, setâ terminatus.
6. *Valvula* valde aucta. *a.* Valvulæ *Basis.* *b. Apex.* *c. Pecten.* *d. Palpus* exterior.
7. *Tubus.* *a a. Laciniæ* interiores obtusæ.
8. *Caput.* *a. Vertex.* *b. Frons.* *c. Nasus.* *d. Occiput.* *e. Labium.* *f. Maxillæ.*
9. *Capitis* pagina inferior. *a a. Genæ.* *b. Jugulum.* *c. Gula* annulo circundata.
10. *Maxillæ* superficies exterior.
11. *Maxillæ* superficies interior.
12. *Labium.*
13. *Antenna.*
14. *Ala* superior. *a. Squamula.*
15. *Ala* inferior. *a. Fissura* marginis tenuioris.
16. *Abdomen.*
17. Abdominis basis intima, *f.* segmentum primum.
18. *Anus* a latere conspectus.
19. *Pes* posticus. *a. Tibia.* *b b. Corbicula.* *c. Planta.* *d. Auricula.*

FIG.

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Apis Tab 13.

**. e. 2

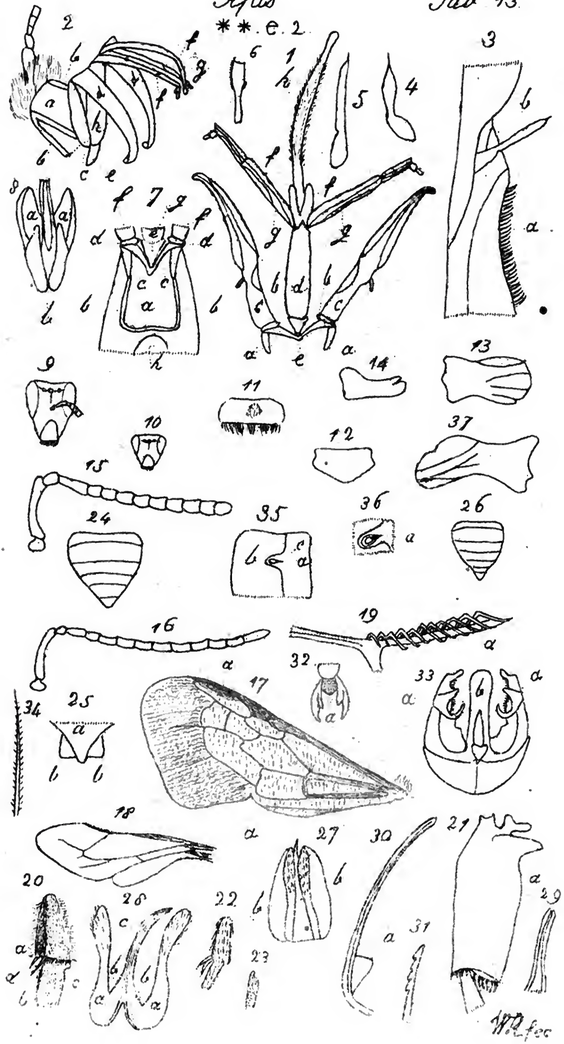

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FIG. 20. *Plantæ* valde auctæ pagina interior. *a. Auricula.*

21. *Pedis* antici portio. *a. Tibia. b. Velum. c. Spinula. d. Strigilis.*

22. *Unguis* valde auctus.

23. Aculei *Vagina.*

24. *Spiculum. a. Retinaculum.*

25. Spiculi apex valde auctus, hinc serrulatus.

TABULA DECIMA-TERTIA.

APIS. **. e. 2.

FIG. 1. *Proboscis* explicata. *aa. Lora. bb. Cardines. cc. Valvulæ. d. Tubus. e. Fulcrum. ff. Laciniæ* interiores *gg. Laciniæ* exteriores. *h. Lingua.*

2. *Proboscis* in actu explicandi. *a. Membrana* lora connectens. *bb. Lora.* c. Valvulæ *Basis. dd* Ejusdem *Apex. e. Fulcrum. ff. Laciniæ* exteriores. *g. Lingua. h. Tubus.*

3. *Valvulæ* pars valde aucta. *a. Pecten. b. Palpus* exterior.

4. 5. 6. *Palpi* exteriores varii.

7. *Proboscidis et Capitis* portio. *a. Gula. bb. Annulus cc. Lora. dd. Cardines. e Fulcrum. ff.* Valvularum *Basis. g. Tubus. h. Jugulum.*

8. *Linguæ* portio. *aa. Laciniæ* interiores. *b. Linguæ* pars.

FIG 9. Caput *A. hortorum* (tom. 2. p. 340.)

10. Caput *A. Scrimshiranæ* (ibid p. 342.)

11. *Labium.*

12. *Labium A. rupestris* (ibid. p. 369.)

13. *Maxilla* aculeatæ.

14 *Maxilla* maris.

15. *Antenna* aculeatæ.

16 *Antenna* maris.

17 *Ala* superior. *a. Nebula* marginalis.

18 *Ala* inferior.

19. *Alæ* inferioris margo crassior. *a. Hamuli.*

20. *Pedis* postici portio. *a. Tibia* corbiculâ cincta. *b. Planta.* *c. Auricula.* *dd. Spinulæ.*

21. *Planta* postica seorsum conspecta. *a. Auricula.*

22. *Pedis* postici pars *A. campestris* &c. (tom. 2 p. 335, 43, 47, 69)

23. *Planta* postica præcedentium sine auriculâ.

24. *Abdomen* aculeatæ.

25. *Anus A rupestris* (tom 2. p 369, 70.) *a* Segmentum ani dorsale. *bb.* Ani segmenti ventralis latera in angulum protensa.

26. *Abdomen* maris.

27. *Aculeus* inter valvas repositus. *a. Aculeus.* *bb. Valvæ.*

28. Idem valvis patentibus. *aa. Valvæ.* *bb. Spicula.* *c. Vagina.*

FIG.

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Tab 14

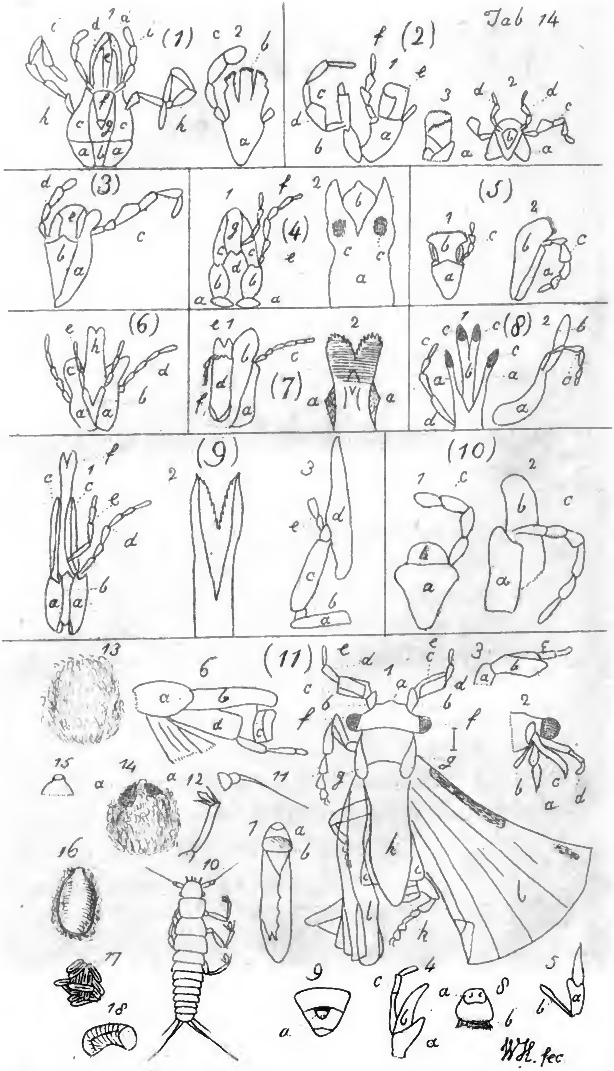

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FIG. 29. *Vagina* extractis spiculis.

30. *Spiculum.* *a. Retinaculum.*

31. Spiculi apex valde auctus, hinc retrorsum serrulatus.

32. *Unguis* valde auctus. *a. Pulvillus.*

33. *Penis.* *a a. Forcipes.* *b. Phallus.*

34. *Pilus* plumosus.

35. Segmenti dorsalis abdominis sectio transversa. *a.* Segmenti basis intima sub præcedentis segmenti margine delitescens. *b.* Segmenti pagina aperta. *c. Spiraculum.*

36. *a. Spiraculum* valde auctum.

Obs. *Spiracula difficillimè deteguntur, nisi sub lente forti, vix ac ne vix, conspicienda.*

37. *Maxilla* aculeatæ, *A. Barbutellæ.*

TABULA DECIMA-QUARTA.

MISCELLANEA, No. 1.

FIG. 1. *Proboscis* generis *Tenthredo,* Linn. *a a.* Valvularum *Cardines.* *b.* Tubi *Fulcrum.* *c c.* Valvularum *Basis.* *d d. Apex* earundem. *e. Lingua.* *f g. Tubus.* *h h. Palpi* exteriores medio crassiores, sex articulorum. *i i. Palpi* interiores.

2. *Lingua* seorsum conspecta. *a.* Linguæ *Basis.* *b. Apex* tripartitus. *c. Palpus* inferior subclavatus, quatuor articulorum.

No. 2.

FIG. 1. *Proboscis* generis *Ichneumon*, Linn. aculeo retracto. *a. Tubus.* *b.* Valvulæ *Basis.* *c. Apex* truncatus, concavus. *d. Palpus* exterior quinque articulorum secundo trapeziformi. *e. Lingua* truncata, semi-cylindrica. *f. Palpus* interior quatuor articulorum, intermediis crassioribus.

2. *Proboscis* generis *Ichneumon*, Linn. aculeo exerto. *aa. Valvulæ.* *b. Tubus.* *c. Palpus* exterior quinque articulorum secundo trapeziformi. *dd. Palpi* interiores quatuor articulorum, articulis intermediis crassioribus.

3. *Lingua* cylindrica.

No. 3.

FIG. 1. *Proboscis Sphecis* cujusdam petiolatæ. *a. Valvula.* *b. Tubus* conicus. *c. Palpus* exterior sex articulorum articulo tertio trapeziformi. *d. Palpus* interior quatuor articulorum. *e. Lingua* concava.

No. 4.

FIG. 1. *Proboscis* generis *Pompilus*, Fab. *aa. Cardines.* *bb.* Valvularum *Basis.* *c. Apex.* *d. Tubus* apice bifidus. *e. Palpus* exterior setaceus, sex articulorum.

rum. *f. Palpus* interior quatuor articulorum. *g. Lingua.*

2. *Lingua* valde aucta. *a.* Linguæ *Basis. b.* Ejusdem *Apex,* trilobus. *cc.* Maculæ duæ pilosæ.

No. 5.

FIG. 1. *Proboscidis* pars generis *Crabro,* Fab. *a. Tubus* conicus. *b. Lingua* apice subemarginata. *c. Palpus* interior quatuor articulorum.

2. *Valvula. a. Basis. b. Apex* rotundatus. *c. Palpus* exterior sex articulorum intermediis crassioribus.

No. 6.

Proboscis generis *Chrysis,* Linn. *aa. Valvulæ. b. Tubus. c.* Valvulæ *Apex* rotundatus. *d. Palpus* exterior quinque articulorum. *e. Palpus* interior trium articulorum, *h. Lingua* apice biloba.

No. 7.

FIG. 1. *Proboscis* generis *Philanthus,* Fab. *a.* Valvulæ *Basis. b. Apex. c. Palpus* exterior filiformis, sex articulorum. *d. Tubus* linearis. *e. Lingua* apice biloba. *f. Palpus* interior quatuor articulorum.

2. *Lingua* valde aucta. *aa.* Ejusdem latera in angulum pilosum protensa.

No. 8.

FIG. 1. *Lingua* quadriloba *Vespæ murariæ*, Linn. *aa. Lobi* laterales. *b. Linguæ* pars intermedia apice biloba. *cccc. Calli* quibus lobi terminantur. *d. Palpus* interior quatuor articulorum.

2. *Valvula. a. Basis* arcuatus. *b. Apex. c. Palpus* exterior sex articulorum.

No. 9.

FIG. 1. *Proboscis* generis nostri *Ammophila. aa. Basis* valvularum. *b. Tubus. cc. Apex* valvularum. *d. Palpus* exterior sex articulorum. *e. Palpus* interior quatuor articulorum. *f. Lingua.*

2. *Lingua* valde aucta, subclavata clavâ bifidâ.

3. *Valvula* valde aucta. *a. Lori* pars. *b. Cardo. c. Basis. d. Apex* semi-sagittatus. *e. Palpi* exterioris pars.

No. 10.

FIG. 1. *Proboscidis* pars generis *Tiphia*, Fab. *a. Tubus* triangularis. *b. Lingua* brevissima, apice rotundata. *c. Palpus* interior quatuor articulorum.

2. *Valvula* valde aucta. *a. Basis. b. Apex* rotundatus. *c. Palpus* exterior sex articulorum, intermediis crassioribus.

No. 11.

FIG. 1. *Stylops Melittæ* (tom. 2. p. 113, 14.) *a.* *Caput* anticè obsoletè trilobum. *bb.* *Antennarum* articulus primus. *cc.* Earundem ramus interior unius articuli. *dd.* Ramus exterior trium articulorum. *ee.* Articulus extimus. *ff.* *Oculi* pedunculati. *gg.* *Elytra.* *h.* *Scutellum* abdomen obtegens. *ii.* *Processus* corneus scutellum utrinque muniens. *k.* *Abdomen* carnosum. *ll.* *Alæ* magnæ, plicatæ.

2. Capitis portio ejusdem a fronte conspecta. *a.* *Palpus* exterior biarticulatus. *b.* *Palpus* interior exarticulatus. *c.* *Antennæ* ramus interior. *d.* Ejusdem ramus exterior.

3. *Antenna.* *a.* Articulus primus. *b.* Ramus interior. *c.* Ramus exterior.

4. *Antennæ* visus alter. *a.* Articulus primus. *b.* Ramus interior. *c.* Ramus exterior.

5. *Palpi* seorsum conspecti. *a.* *Palpus* exterior. *b.* *Palpus* interior.

6. *Corporis* pars a latere conspecta. *a.* *Thorax.* *b.* *Scutellum.* *c.* *Abdomen.* *d.* *Processus* corneus supra dictus.

7. *Larva* insecti præcedentis. *a.* *Os?* *b.* Concavitas sub capite.

FIG. 8. *Capitis* ejusdem pagina superior. *a. Os? b. Occiput.*

9. Abdominis *Melittæ* portio. *a. Larva Stylopis Melittæ* capite solo exerto.

10. *Pediculus Melittæ* valde auctus (tom. 2. p. 168.)

11. *Antenna* ejusdem.

12. *Pes* ejusdem.

13. Folliculus *A. manicatæ* (tom. 1. p. 175. 2. p 248.) tomento tectus.

14. Idem parte tomenti exutus.

15. Apex ejusdem ad caminulum *f.* spiramentum exhibendum.

16. Idem cum tegumento exteriori ex parte abscisso, ut folliculus interior pateat.

17. Moleculæ vermiformes e polline melle humectato confectæ, quibus folliculus obducitur, et mediantibus quibus tomentum ei adhæret.

18. *Larva A. manicatæ.*

END OF VOL. I.

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